

THE Color^{*} Computer^{*}

MAGAZINE

October 1983

\$2.95

For TRS-80® Color Computer & TDP-100™ Users

The New Color Computer Revealed

Orbit

A Space Simulation

Graphics For Beginners

Magic

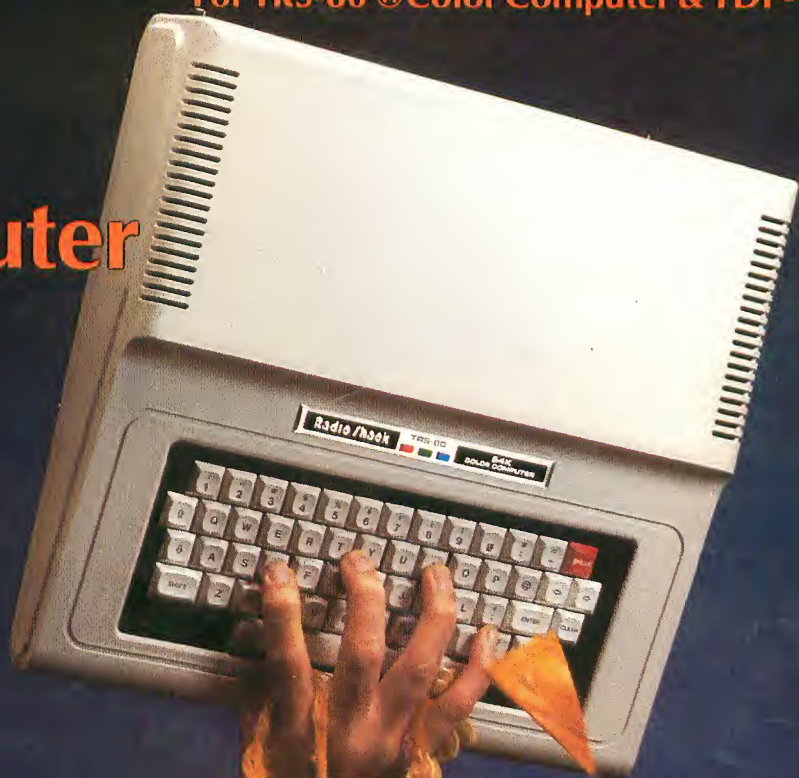
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—Part 4



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* All machine code D Disk Compatible

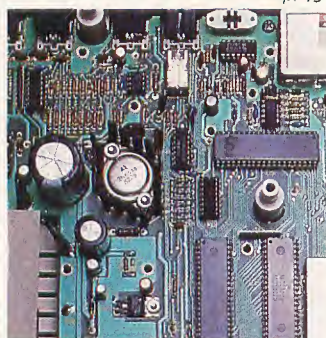
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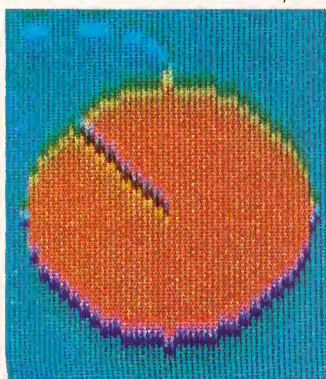




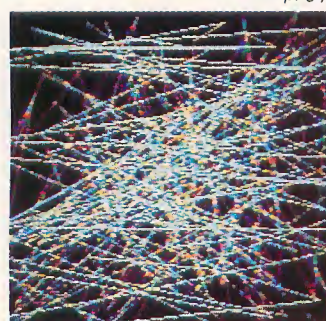
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FEATURES

- 14/Tools** by Brian Alsop (General)
Here's what you need on hand to do simple hardware projects.
- 19/Magic Pumpkin** by George and Ellen Aftamonow (Game)
This game is a treat that won't go in a Hallowe'en bag.
- 24/A New Machine** by Kerry Leichtman (General)
Radio Shack has let two important new products out of the bag!
- 31/Custom Color** by Dennis Kitsz (Hardware)
64K upgrades and more!
- 49/Color Computing For Kids** by Jean Plesser (Education)
There's a Hallowe'en treat in this second lesson.
- 57/Dissecting Your ROM** by Jake Commander (Tutorial)
The fourth of a 12-part series examining the Color Computer ROM, bit by bit.
- 64/Orbit!** by Tom Goodrick (Game)
This game is really a simulation that will require all your skill.
- 94/Graphics? Yes!** by Scott Bain and Andrea Chartier (Graphics)
This is the first in a series on graphics aimed at beginners.
- 98/TLC** by Isaac Szlechter (General)
Follow these rules to make your computer feel good!
- 107/Cryptography** by Robert L. Garrett (Game)
Here's another game that really is — or can be — serious business.

DEPARTMENTS

4/PEEK (10,83)

11/INKEY\$

77/GOTO SCHOOL by Dr. Paul Kimmelman

102/DEFUSR by Terry Kepner

110/REVIEW\$

Here's the word on FLEX/OS/9, Rear Guard, Game Writer, Speak Up! and others.

124/NEW:PRODUCT\$

128/END OF FILE

128/FOR...NEXT (11,83)

Cover

Birth of a Computer by Charley Freiberg; arm by D. Ezequille

ABC membership applied for.

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Did you look carefully at that pumpkin bursting apart on our cover? I bet you never realized what actually happens during the birth of a new computer — I know I didn't. Not until I watched the latest and greatest in the Color Computer family rising out of the pumpkin slime did it really come home to me what progress has been made in digital technology. To think that it was a 6809 chip propelling the Great Pumpkin all this while...

The best part was that the new Color Computer worked wonderfully well, first thing. All we did was brush the seeds off and plug it in. (Which came first, the pumpkin or the computer?) It was really no trick at all, but a great treat! And for more information on the new Color Computer, and its newly-born cousin, the Multi-pak Interface, GOTO 24, where Editor Leichtman hands out a treat bag of information.

The fey winds of Hallowe'en have reached out cold, ghostly fingers to type on the keyboards of many of our authors' computers, and this month's bag of goodies is overflowing with signs of the season and treats for the willing. GOTO 18 to be visited by a ghost, a witch and a Magic Pumpkin conjured up by George and Ellen Aftamonow. GOTO 49 for a new children's lesson on computers, and discover (if you dare) what spooky treats were left behind by passing spirits for Jean Plesser to delight her guests with. Finally, GOTO 31 for the long promised, long awaited, long-time-coming 64K Upgrade by Dennis Kitsz, invisible in last month's issue.

Those of you who don't believe in ghoulies and ghosties and long-legged beasties should GOTO 57, to discover with Jake Commander the inner secrets of the Basic which make your computer do its tricks.

Then take a trip into outer space and man your own space vehicle in Orbit! (GOTO 64). You'll find seat-of-the-pants maneuvering against time and space to be well represented and exciting in this simulation.

Do you have secrets? Need to send a message to rich old Aunt Nell that's meant for no other eyes? Have a lover you want to woo in a public place? Planning to go into the spy business? GOTO 107, where the ways of cryptography are unveiled. With this program you can confuse and befuddle — unless, of course, the interceptor also reads this magazine.

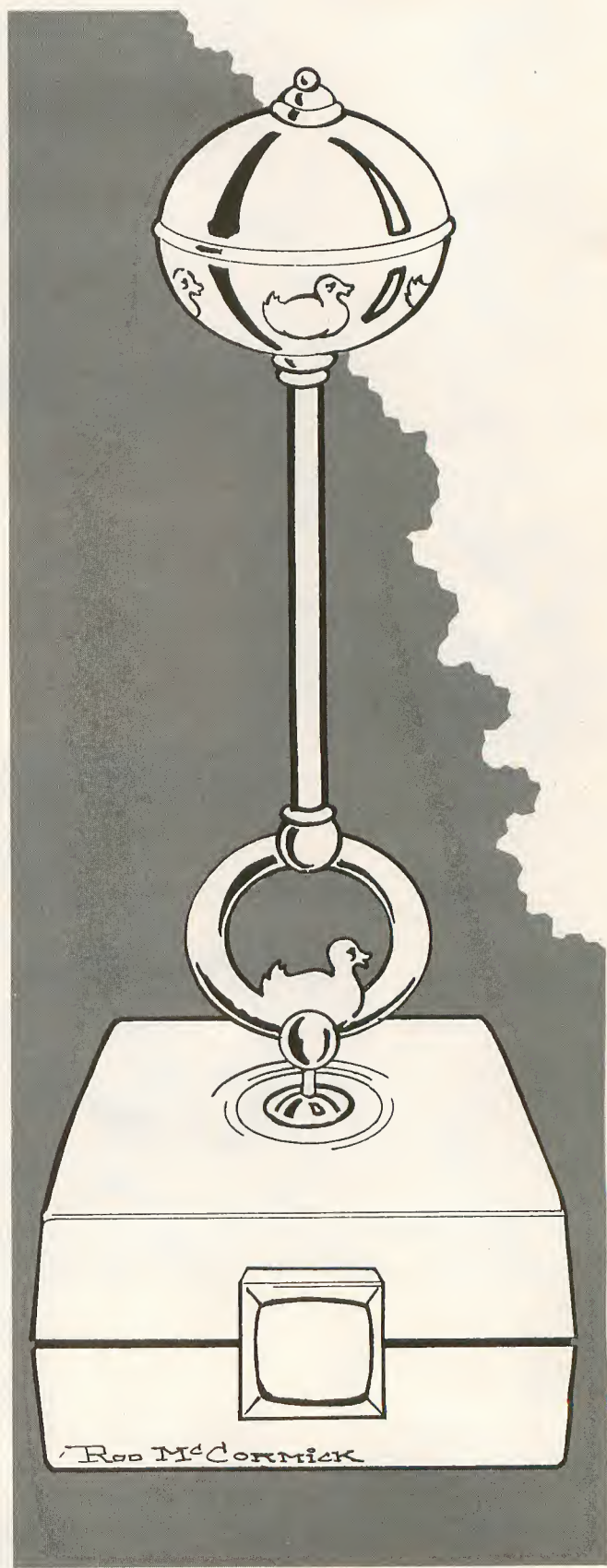
Beginners to the world of hardware should GOTO 14 for an introduction to the tools and equipment you'll need to begin hardware projects. Those of you who can't recognize a soldering iron in a group of two tools — here's your chance to learn!

GOTO 98 to discover what a little TLC can do for you and your computer.

Graphics? Yes! We all love graphics. GOTO 94 for part one of a graphics series that will take beginners from pixels to pictures.

Finally — GOTO 77 for GOTO School, the educator's column that no educator should be without, and GOTO 102 for the column that has answers for all your questions.

— D.M., Managing Editor





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GREAT NEW ADVENTURE ADVENTURE IN WONDERLAND 100% MACHINE LANGUAGE

We are going to go out on a limb here. We believe very strongly that this is the BEST adventure game ever written for the color computer. That's right, we said the BEST — no exceptions!!

Adventure in Wonderland is 100% machine language, and completely fills a 32K machine. The program has a vocabulary of literally HUNDREDS of words, and uses a full "ELIZA" type of intelligence simulator. That means you can give commands and conduct conversations in WHOLE SENTENCES if you like!! Try that with any other adventure!

This is a fantasy world peopled with the creatures of Lewis Carroll's imagination. "Alice's Adventures in Wonderland", "Through the Looking Glass", and "The Hunting of the Snark" have been blended into a delightful landscape. You will play the role of Alice as you wander through the garden of live flowers, the treacherous Tulgey Wood, the chessboard landscape, the wabe, and all the other familiar Wonderland scenes. You will meet, and talk with, the beamish Tweedle Dee and Tweedle Dum, the mimsy Mock Turtle, the uffish Duchess, the immortal Humpty Dumpty, and a dozen other Wonderland characters. And, of course, you will chit-chat with the Cheshire Cat!!

As we said, you have a vocabulary of HUNDREDS of words — not the usual stingy 30 or 40. The program's response to these words will vary depending on the situation, where you are, who you

are talking with, what you have said in the past, and the way in which the words are combined. Your task is to become Queen, save Wonderland from the Snark, and manage to return home. You may feel completely trapped in certain places in Wonderland, but there is always a way out . . . in fact, there are always (at least) three exits from each trap. An open mind, a pure heart, and a touch of Wonderland madness will keep you from despair!!

This is not an easy adventure, and will provide ample challenge for the most experienced adult players, but you will have so much fun conversing with the denizens of Wonderland that you may not want to leave anyway. We want to repeat what we said above, because we really mean it. WE BELIEVE THIS TO BE THE VERY BEST ADVENTURE EVER WRITTEN FOR THE COLOR COMPUTER. After you have tried it, you'll think so too! 100% machine language — Fully 32K long. **Tape - \$24.95; Disk - \$29.95**

Programs are available on AMDEK cartridges - add \$5.00 to the disk price.

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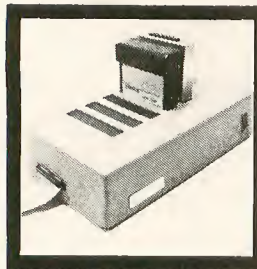
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Technical Editor Jamie Tietjen

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Education Editor Dr. Paul Kimmelman
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Contributing Editors William Barden Jr.
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Ad Production J.L. Patterson

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Publisher James S. Povec

Director of Marketing Carl Cramer

Advertising Director David J. Ezequille
(207) 236-9621
Highland Mill
Camden, ME 04843

Advertising Scheduler Caron L. Taylor

Circulation Director Lori A. Hellevig

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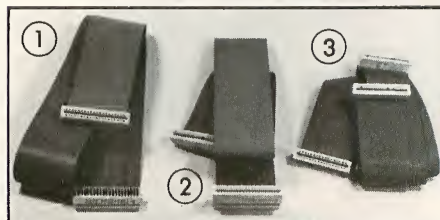
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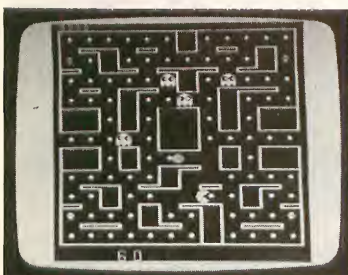
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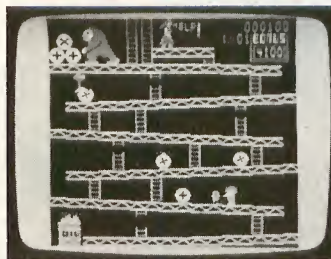
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From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Requires 16K. Tape: \$21.95, Disk: \$25.95

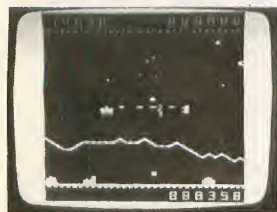
DONKEY KING



DONKEY KING

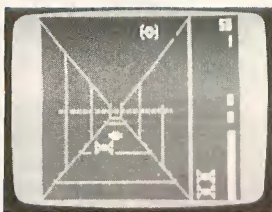
You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: \$24.95, Disk: \$27.95

GHOST GOBBLER



PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: \$24.95, Disk: \$27.95



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Your space fighter roars into the Death Corridor. Lock-on and blast the enemy fighter from the sky. Now try dropping one into Death Star's narrow exhaust vent. It takes skill and guts. Good luck! With "Star Wars" theme song. From Anteco. Requires 16K. Tape: \$24.95



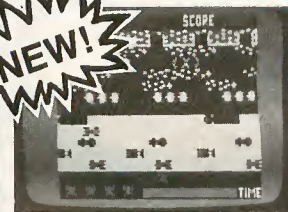
ANDROID ATTACK

Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: \$21.95



CREATURE FEATURE

From Color Software, comes a lightening swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: \$17.95. Disk: \$19.95



FROGGER

Just released by The Cornsoft Group, this is the officially licensed version from Sega, the arcade manufacturer. It has it all! 4 lane super highway, snakes, turtles, logs, alligators, etc. Lots of action and laughs! Requires 16K. Tape: \$19.95

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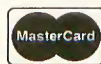
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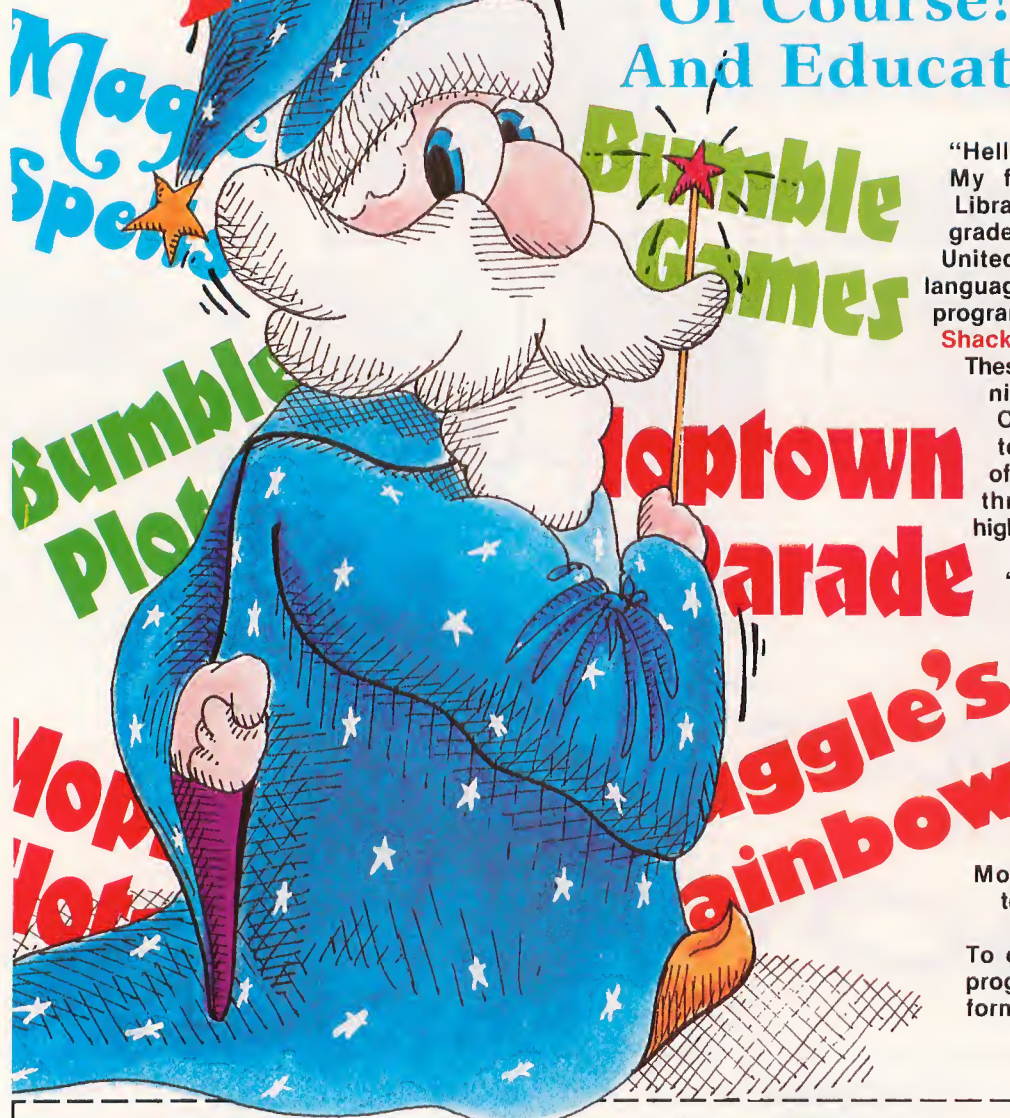


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INKEY\$

The Color Computer Magazine
Highland Mill
Camden, ME 04843

Copy

I have a tip for disk users with only one drive: COPY "PROG/EXT" and then press Enter. The disk manual doesn't tell you that this can be done with one drive, but it can. The computer then prompts you with "Insert destination disk"; then press Enter.

Victor Straub
Bayshore, NY

Musical Fix

Since my teenage daughter is "into" music, but not computers, I introduced her to "Musical Tales" (April, 1983). We spent hours entering the program only to discover the program wouldn't load. The following changes will get the program up and running:

```
10 PCLEAR 1
15 CLEAR 5000
200 INPUT "IT HAD TO BE
    10"; BZ$
350 INPUT "TAKING 25";
    XP$
440 INPUT "I 34"; XQ$
830 PRINT "IT HAD TO BE
    " BZ$"."
1050 PRINT "AND TAKING"
    XP$
1170 PRINT "I "XQ$"."
785 CLS
895 CLS
995 CLS
1115 CLS
1225 CLS
```

H. Peterson
Barrington, RI

Color Screen

I really enjoy **The Color Computer Magazine**. I read it cover-to-cover. J.R. Hilton wanted some non-Extended programs that he could put into his computer. Here's a program for a standard Color Computer which uses the CHR\$ command to color the screen in different patterns:

```
10 For S=128 to 255
20 For X=0 to 510
30 Print @ X, CHR$(S)
40 Next X,S
```

Matt Jones
Pinetown, NC

MC-10 Club

Owners and potential owners of the MC-10 Micro Color Computer interested in starting a users group, please send an S.A.S.E. to Bob Kantor, 36 Prospect Ave., Ossining, NY 10562. Inquiries accompanied by S.A.S.E. will receive the group's newsletter and membership survey. Only S.A.S.E.'s will be acknowledged.

Bob Kantor
Ossining, NY

More DBM Fix

Thanks for an excellent magazine, I look forward to each issue.

I was most interested in the DBM program in the premier issue, but had some problems with it.

No matter how many records I set the program to, on a single field sort, I received a BS (bad subscript) error in Line 6140. By trial and error I've found a way to run single field sorts without the error.

Insert Line 6115 IFZ=Q THEN 6160 to run the program without the BS error.

Ed Smith
Camden, ME

Update

I just purchased **The Color Computer Magazine** on tape and when I tried it I found I/O problems throughout the tape.

W.M. Shilling
Fountain Valley, CA

Any defective tape may be returned to us for replacement. We guarantee satisfaction.

— Eds.

Thanks Paul

Thanks for a great magazine, especially Paul Detwiler's "How to Borrow Money" (May, 1983).

If you make the following changes to his program, it will also calculate the effects of pre-paying a loan. Not even my bank's computer was able to do this.

```
135 PRINT: INPUT "INPUT
PREPAYMENT IF ANY"; PP
250 B(Z)=B(Z-1)-(MP+PP-(I(Z))
Thanks Mr. Detwiler, you
helped us buy a home!
```

Chuck Nungester
Truckee, CA

MC-10 News

I have some interesting information to share about the new MC-10 Micro Color Computer. Those of you who have a Color Computer and have purchased

a printer that operates at a higher baud rate than the Radio Shack design of 600 baud, and have, or will have, the new MC-10 Color Computer and don't want to switch the printer baud rate back and forth, I have news for you. Simply POKE decimal address 150,7 and the Color Computer delivers 4800 baud. POKEing 150,1 will give you 9600 baud.

The manual for the Radio Shack MC-10 Color Computer is nearly worthless to anyone with previous Color Basic experience. I have discovered that video RAM is from 16384 - 16896. I wanted to print the entire ROM but did not want to alter my printer to the 600 baud rate of the MC-10, nor did I wish to wait forever for the print-out, so I located the baud rate control bytes. For 110 baud POKE 16932, 255. For 300 baud POKE 16932, 59. For 2400 baud POKE 16932, 27. For 4800 baud POKE 16932, 11. And believe it or not, for 9600 baud POKE 16932, 2, and it transfers error free at that rate with no problems. So, now with my ROM printed out I now know this machine has commands not listed in the manual, such as EXEC.

Bob Coyle
Dayton, OH

OK Now

Thank you for "Damage Report, Mr. Scott." Your instructions worked. When I received the May issue I was in such a rush to play the game I started programming before I had my computer upgraded from 16K Basic to 16K Extended Basic. Much of what I programmed before upgrading needed to be re-entered, but deleting through Line 70 then re-entering it got me started in the right direction.

I look forward to learning more about my computer and using your magazine to help me enjoy it.

Kenneth C. Faba
Bartlett, TN

Don't Do It!

Scott Norman's implication that inserting ROMpaks in the Color Computer with power on is an unacceptable practice. Such a practice is, at best, foolhardy, and at worst, *expensive!* For those who read his review in the June issue: live with the gunk. It can be removed with a cotton swab soaked with alcohol or spot remover. Or, if you happen to be more experienced with circuit board repair and modification, simply cut the trace.

I agree that the Color Computer is one of the best home computer values for the money available today, but Tandy spared every expense in its design. For another \$50 we could have had a real D/A converter, a USART, a composite video output (as well as RF), and a buffered cartridge interface. Unfortunately, cheap is almost always better than good, so we're stuck with an anemic power supply and unbuffered expansion capability. It's *never* a good idea to plug in circuit boards with power on, but with that unbuffered interface, it wouldn't take much to destroy every IC connected to the bus. In the Color Computer, that means virtually every chip on the circuit board.

The Color Computer is a very powerful machine for a very low price: it's just not built to take a lot of carelessness. When they say "turn power off", they mean it!

R.E. Young
Rochester, NY

Fig-Forth Query

I disagree very much with the author of the fig-Forth review (July, 1983) and his suggestion for the book *Starting Forth*, by Leo Brodie. It is a fine book, but it is for Forth-79, not fig-Forth. I have the Armadillo ColorForth package, and I thought I was going crazy when I bought that book. I found that none of the example programs worked. Only through careful reading was I to discover there are two major versions of Forth.

A better suggestion for a beginner's book is *Forth Programming*, by Leo J. Scanlon. It covers Forth-79 and Fig-Forth with the important differences clearly defined. It also states many definitions of exclusively Forth-79 words so you can easily convert from one to the other. Also do you know of any magazines that cater to the Fig-Forth user?

Dale Maledon
Austin, TX

Gregg Williams Replies

I'm sorry you had trouble with Leo Brodie's Starting Forth book; even though I have worked to date with Fig-Forth only, his book never confused me. Since I have not seen Scanlon's book, I can't comment on it, but please use it if you find it helpful. However, no book written to date surpasses Brodie's book in terms of explaining the finer points of Forth; I'm sure you'll come back to it eventually. Forth Dimensions, the magazine of the Forth Interest Group, is the only Forth-oriented magazine I know of, but they do not cater to Fig-Forth. As a matter of fact, they lean toward Forth-79. But I should emphasize that the differences between the two versions are minimal, so you should be able to make the slight changes needed to convert code from one to the other. If you can't, Forth may not be the language for you.

—Gregg Williams

Computer Clubs

Birmingham CC Club. Anyone interested in joining the Greater Birmingham area CC Club, contact J. Bell, Jr., at P.O. Box 337, Gardendale, AL 35071 or call (205)631-3320.

Phoenix CC Club meets the first Tuesday and third Wednesday of each month at 7 p.m. at the American Legion Post #1, Phoenix. Contact Mike Huffman at (602)939-5666.

Halifax-Dartmouth Users

Group meets the third Monday of every month at 7 p.m. in the Dartmouth Regional Library Auditorium. Contact the club at P.O. Box 572, Dartmouth, NS B2Y 3Y9.

More RS Video

Congratulations to Steve Odneal on his RS Video article. This program opens up all kinds of possibilities for Basic programmers. I would like to know if I can use Steve's program in my own Color Computer programs. I would also like to see another article on the reformatting program that goes into more detail on the actual operation of the routines; maybe with some logical flow charts to help explain the functions.

Tony Byorick
Biloxi, MS

All programs published in **The Color Computer Magazine**

are intended for our readers' personal (non-commercial) use and enjoyment. — Eds.

Problems, Problems

I received a free copy of your first issue and immediately sent in the subscription card. I waited until April 10 for the second issue and then sent in the Reader Service card marked for subscription. Now, two months later, I still haven't received my subscription. What gives?

Joseph Bell, Jr.
Gardendale, AL

We have had more than our fair share of problems with our fulfillment house. We have spoken with them and corrected your problem, and we will be happy to do the same for any of our readers in similar straits. — Eds.

Fix (07,83)

Don Wood's "GOTO Where?" article in the July issue should read:

To gain the maximum amount of available memory type:

POKE 25,6:NEWENTER

- Step 1. CLOAD the first program.
- Step 2. Type: PRINT PEEK(25), PEEK(26) Enter
Make a note of the two numbers printed.

- Step 3. Type: PRINT PEEK(27), PEEK(28) Enter
If PEEK(28) is greater than 1, go to Step 5.

- Step 4. Type: POKE 25, PEEK(27) - 1:

POKE 26, PEEK(28) + 254 Enter

Go to Step 6

- Step 5. Type: POKE 25, PEEK(27): POKE 26, PEEK(28) - 2 Enter

- Step 6. CLOAD the second program.

If the first line of this program does not have a higher number than the last line of the program loaded in Step 1, use the renumber function to give it higher line numbers. The first program will not be affected by a renumber at this point.

- Step 7. Type: POKE 25, the first value noted in Step 2 ENTER
POKE 26, the second value noted in Step 2 Enter.

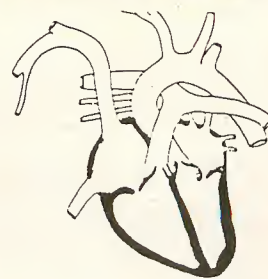
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Sherlock Holmes/Agatha Christie fans-It's finally here—A murder mystery game for the 80-C! Mr. Goodbody has been killed in his mansion and you must solve the mystery. WHO committed the murder, WHERE did it occur and HOW was it done! Question suspects, find the secret passage, and break the code to get clues. Hi-Res graphics enhances this excellent game. The computer records the clues you obtain on a clue inventory screen and also provides suspect descriptions at the touch of a finger. A fast, fun game that will sharpen your deductive skills. Every game is different!

32K Extended \$19.95



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Save hours of tedious work with this efficient program. Calculates individual player average, high game and total pins, as well as team games won/lost, high series, and cumulative total team points. Also calculates team standings for each week in order from 1st to last! All data stores to tape and outputs to printer to provide professional, easy to read copy. After initial input of league and player names all you have to do is input each week's scores - the computer does the rest!!!

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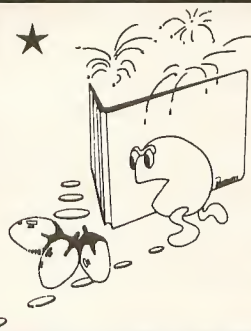
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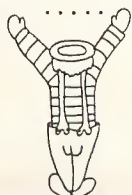
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Tools

Want to get started on construction projects, but don't know what tools you need? Here's a handy guide to the basic outfit.

MOST CONSTRUCTION articles assume you already have the tools for the job. For many of you getting started in construction this is a false assumption. If you don't have the tools, what tools should you get? It used to be that you needed a complete metal working shop and electronics tool shop to tackle a home project; semi-conductors and ICs have changed that. Only a few basic tools (see Table 1) are needed to construct more than 90 percent of the projects published. That's the good news; the bad news is that the price of tools has also changed. Expect to pay about \$100 to get the basic tools shown in Table 1.

This article will help those without electronics tools. Hopefully, it will prevent the purchase of tools that are only occasionally used. The photo shows the tools I've found most useful. Some are over 20 years old and should last longer. Following is a description of the tools you'll need.

The Tools

VOM The Volt-Ohm Meter (VOM) is indispensable for construction projects. It can measure voltages, check capacitors, measure resistances, check logic levels, verify electrical continuity and can even check transistors. You'll need one with a sensitivity of at least 20,000 ohms/volt. This type of meter will not affect circuit operation when used to check a working circuit and usually has enough voltage ranges to read voltages from 1 to 15 volts accurately.

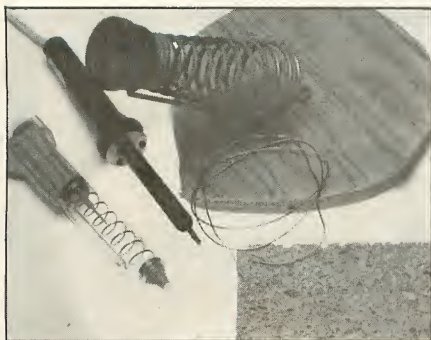


Photo. Soldering Iron and Holder

Soldering Iron And Accessories

When working with ICs and transistors, the right soldering iron, tip and solder is a must. I found that the most useful kind of soldering iron has a separate handle, heating element and tip. Tips wear out every few months; heating elements wear out every few years, but handles almost never wear out. Imperial, Ungar, Weller and Radio Shack sell this type of soldering iron, but the big difference is price. The non-Radio Shack irons cost about \$30 and are made for commercial applications. A Radio Shack 64-2080 handle, 64-2081 27-Watt heating element and two 64-2089 iron clad tips cost about \$15. I've found this combination to be most satisfactory. I recommend the iron clad tips because they last longer and can easily be removed. Copper tips tend to seize up and are difficult to remove if some anti-seize compound isn't applied before you first attach the tip to the handle. Spade shaped tips are the most versatile. I modify mine for work on printed circuit boards (PCBs) by filing them 15 percent on each side of the tip. The smaller tip size helps solder more accurately between IC pins. You can refile a tip when it gets corroded and restore it to almost new.

You should use a thin solder, 60 percent tin and 40 percent lead with a rosin

core; get the type that's 0.050 inch diameter or thinner. I use 0.028 inch diameter solder. I suggest buying a large quantity of solder at one time. Ounce quantities sell for about \$1.50 while half pound quantities sell for about \$5. I bought a pound roll three years ago and am still using it!

A tip cleaning sponge is very useful; it gets rid of the slag that accumulates on the tip during use. Wet it before using. These sponges sell for less than \$2.

Now that you have the iron, solder and sponge, how do you prevent a fire or avoid burning your hand? A holder for the iron is a must. It keeps hands and combustibles away from the iron. You can buy one for \$6 and up. I made one from a block of wood, a coat hanger, a strip of metal and a few nails. Form the two coat hanger supports and nail them to a piece of 2-by-4, then position a U-shaped piece of metal over the tip area and nail it down.

Diagonal Cutters and Pliers Do yourself a favor and spend about \$15 each for a good quality diagonal cutter and needle-nose pliers. The type sold in most stores is too large for use in most computer-related projects. The miniature or jeweler's sized tools are more useful. The Jensen catalog* has a good selection of these tools. The diagonal pliers shouldn't be any longer than 4½ inches and of the flush cut design. Needle-nose pliers with serrated jaws perform best for a wide variety of uses. Get needle-nose pliers that are designed for work in close quarters. Remember, the pins of an IC are only

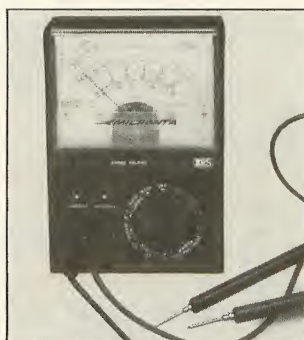


Photo. Volt-Ohm Meter

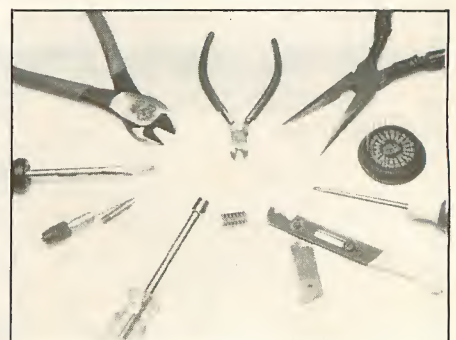


Photo. Small Tools

0.100 inch apart. You often have to wrap wires around such leads before soldering.

Screwdrivers And Nutdriver Two sizes of standard tip and Phillips screwdrivers can handle most projects. You can find them at the local hardware store. The small standard tip screwdriver with a 1/8-inch blade can be used for 4-40 hardware. It can also be used to pry IC's from sockets by inserting it under one side and sliding it like a wedge. A 1/4-inch slotted tip screwdriver handles other work. A Phillip's tip screwdriver with 3/16-inch blade diameter will open your Color Computer. You'll need the smaller one for many imported screws. A 1/4-inch hollow shaft nutdriver is the most common size for TV's and for 4-40 hardware nuts. A nutdriver is indispensable.

Miscellaneous

Other items often needed are Super Glue, IC sockets, a small drill and tape. You can use Super Glue to glue IC sockets to PCBs. You'll need a Number 55 to 60 drill to drill holes for IC sockets and wires; these can be found in hobby shops. You'll need tape for many projects, to bundle wires together and tape wire joints. Get a good brand and cut it to size (don't tear it). Masking tape can be used just as well for low voltage circuits and temporary wire bundling.

Don't ever attempt an electronics project using ICs without IC sockets. Take it from one who has soldered too many ICs backwards. It's worth the 20 cents each socket costs. Removing soldered ICs is a real pain!

Summary

Good tools aren't cheap; however, they should last for years. I hope this article has provided some guidance to those getting started in home projects. It's too easy to be overcome by the bewildering assortment of available electronics tools.

Table 1. Tool List

Diagonal cutters
Solder
Number 55 to 60 drill
Two Phillips head screwdrivers
Electrical tape
IC sockets
Soldering iron, heat cartridge, and tip
Needle-nose pliers
Super Glue
Two slotted-tip screwdrivers
Volt-Ohm Meter

The Original

FLEX for Color Computers

- * Upgrade to 64K
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- * Move RS Basic to RAM
- * Load and save function on FLEX disk
- * 24 Support Commands 12 with Source Text

Languages Available

Pascal, Fortran, RS Basic, RS Assembler, TSC Basic, TSC Assembler, Relocating Assembler, Macro Assembler, Mumps

If you are tired of playing games on your TRS-80C™ Color Computer, or find that you are handicapped by the limitations of the RS BASIC in trying to write a Program that will allow you to actually USE the Color Computer as a COMPUTER, YOU ARE READY TO MOVE UP TO THE FLEX9™ Operating System. If you want to have REAL PROGRAMMING POWER, using an Extremely Powerful Business BASIC, PASCALS, C Compilers, a full-blown Macro Assembler with a Library capability so you are not continuously "reinventing the wheel", YOU ARE READY TO MOVE UP TO THE FLEX9™ Operating System. If you would like to see if YOU REALLY COULD USE A COMPUTER IN YOUR BUSINESS, or begin to make your Computer start PAYING IT'S OWN WAY by doing some Computer Work for the millions of small business around you, such as Wordprocessing, Payroll, Accounting, Inventory, etc., then YOU ARE READY TO MOVE UP TO THE FLEX9™ Operating System. How?? DATA-COMP has the way!

DATA-COMP's FLEX9™ Conversion for the TRS-80C™ Color Computer was designed for the SERIOUS COMPUT-

ER USER: with features like greatly increased Display Screens, WITH Lower Case Letters, you can put a FULL Menu on ONE Screen, or see SEVERAL Paragraphs at the same time; with features like providing a FULL Keyboard so you have FULL Control of your Computer AND it's Programs NATURALLY, without needing a chart to see what Key Combination will give you what function; with USER ORIENTED functions to make using the Operating System natural, like having the Computer AUTOMATICALLY determine what type of Disk is being used in what type of Disk Drive and working accordingly, rather than you have to specify each and every thing for it, or like having the Computer work with the Printer you have been using all along without you having to tell the new Operating System what is there; etc., etc., etc.

DATA-COMP has everything you need to make your TRS-80C™ Color Computer WORK for YOU; from Parts and Pieces to Full, Ready To Use SYSTEMS. DATA-COMP designs, sells, services, and SUPPORTS Computer SYSTEMS, not just Software. CALL DATA-COMP TODAY to make your Computer WORK FOR YOU!

System Requirements

FLEX9 Special General Version w/Editor & Assembler (which normally sell for \$50.00 ea.)	\$150.00
F-MATE(RS) FLEX9 Conversion Route, for the RS Disk Controller	
when purchased with Special General FLEX9 Sys.	\$49.95
when purchased without the General FLEX9 Sys.	\$59.95
Set of Eight 64K RAM Chips w/Mod. Instructions	\$59.95
Color Computer with 64K RAM and EXT. BASIC	\$399.95
Radio Shack Disc Controller w/manual	\$179.95

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SPECIAL SYSTEMS PACKAGES

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Circle No. 11 on Reader Service Card

B L A C K J A C K P R O



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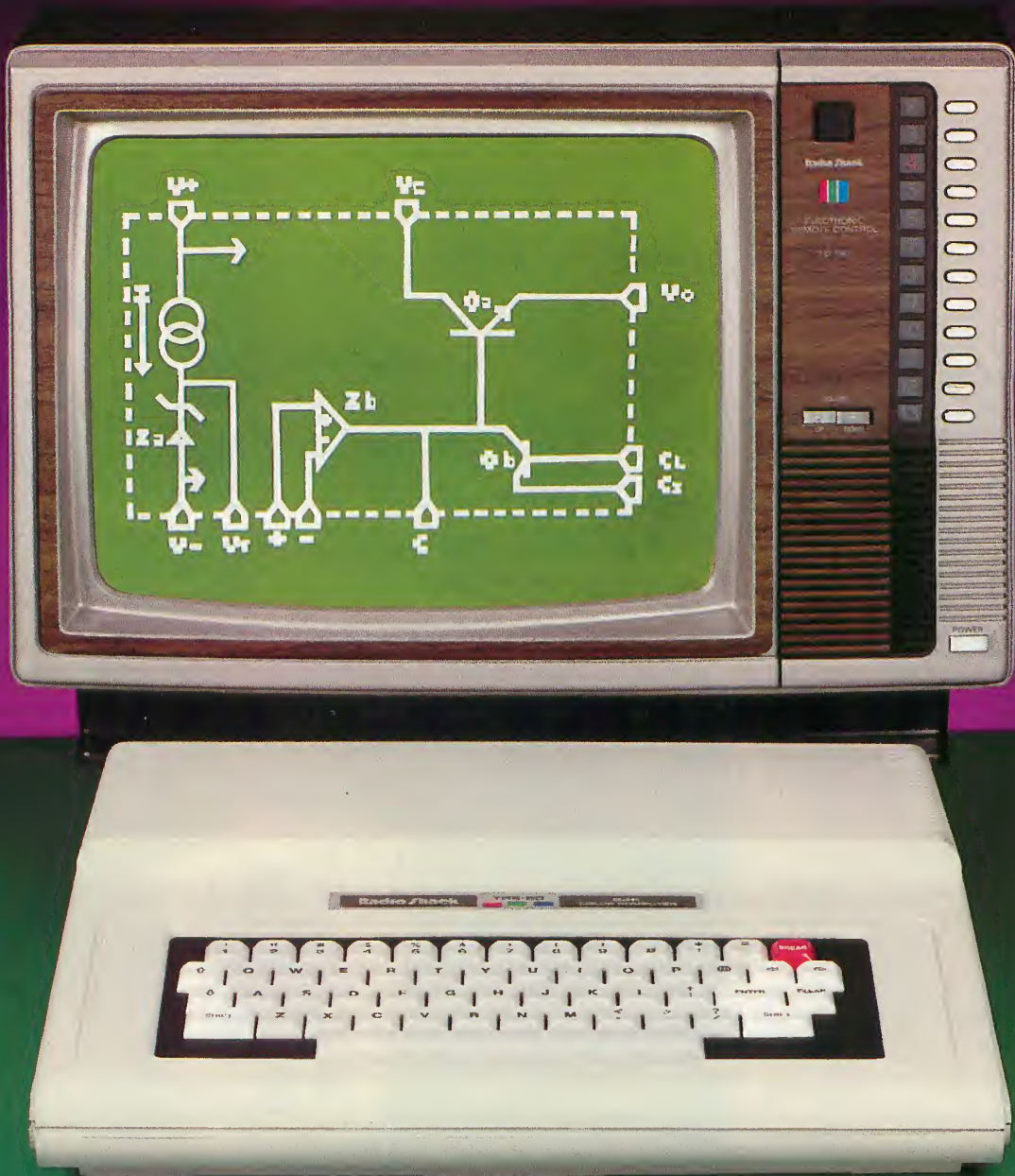
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to condition you to make
the correct play effortlessly
and beat the house.
Read about BLACKJACKPRO on page 47.

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S K I L L W A R E

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You can easily create sophisticated, high-resolution graphics using simple one-line commands. You can produce drawings, business charts, engineering diagrams, even animation. Screen resolution can be up to 256 x 192 (49,152 pixels). In addition, Extended BASIC allows multi-character variable names, string arrays up to 255 characters, full-featured editing, tracing, floating point 9-digit accuracy, trigonometric functions, user definable keys, specific error messages and PEEK, POKE and USR commands to call machine language subroutines.

Powerful Disk Operating System

Add a Color Computer Disk Drive (26-3029, \$399.95) and our new OS-9 with Editor/Assembler (26-3030, \$69.95) and you have the perfect system for the advanced programmer. OS-9 is a real-time disk operating system that accesses the entire memory of the 64K Color Computer. It's designed for the 6809 microprocessor and includes functions for disk and terminal input/output, software memory management and multi-tasking. OS-9 contains approximately 40 utility programs used for system and disk file maintenance and control.



**OS-9 with
Editor/Assembler**

With the TRS-80 Color Computer's big 64K memory and the superior OS-9 operating system, you can develop powerful assembly language applications. Programming in machine language means more efficient memory use and faster execution of real-time action. In addition to converting assembly programs to 6809 machine language, the OS-9 assembler will produce a formatted program listing and alphabetized symbol table listing. It can also convert compiler-produced programs.

Other Support Features

OS-9 also gives you a text editor and debugger. You can edit single characters and groups of characters, plus single lines and blocks of lines with the text editor. And the macro definition facility lets you create new edit commands. The debugger is designed to facilitate testing of machine language programs. It includes commands to examine, dump, change and test memory; examine, change or initialize registers; insert and/or remove program breakpoints; execute programs; run OS-9 commands; and evaluate and convert arithmetic expressions in or to binary, hexadecimal or decimal number systems.

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To learn about all the features of the new TRS-80 Color Computer, stop in today at your nearest Radio Shack Computer Center or participating Radio Shack store or dealer. We also carry a complete line of software and peripherals to make your Color Computer even more versatile. Be sure to ask about our new BASIC-09 language (26-3036, \$99.95). It's an enhanced version of standard BASIC written for the 6809 processor, and includes features derived from PASCAL for structured programming.

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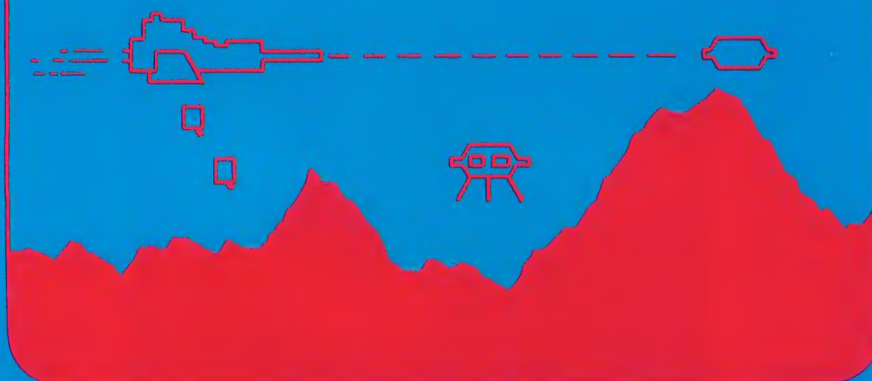
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Here's a Hallowe'en game to keep your ghosties and ghoulies busy!

Magic Pumpkin



WITH ALL THE WITCHES, ghosts and goblins haunting the outdoors on Halloween, it seems appropriate to invite a few in for an enchanted brew and a game played on our Color Computer. This is a computer version of that old favorite, the African Hand Game, with a Halloween twist.

When the moon is bright and the witching hour approaches, load this program. Remember – not all things that go bump in the night get along with one another. In "Magic Pumpkin," a witch eats a pumpkin and wins the round; a ghost scares a witch to death, to win the round; and a magic pumpkin can exorcise a ghost, to win the round. The witch, ghost and pumpkin replace the traditional scissors, paper, and rock.

Each character has an equal chance of winning. The object of the game is to outsmart the computer, which will randomly choose a ghost, witch or pumpkin. Once you have entered your selection, your choice and the computer's random choice are graphically displayed.

The computer will also tell you who won the round, and keep score for the user and computer. The game will continue as long as you enter choices.

Game instructions are simple and self-explanatory, displayed on the screen before the game begins. The game starts automatically.

Don't eat too many pumpkins! ■ ■ ■

by George and Ellen Aftamonow



Photo. Magic Pumpkin Title Screen

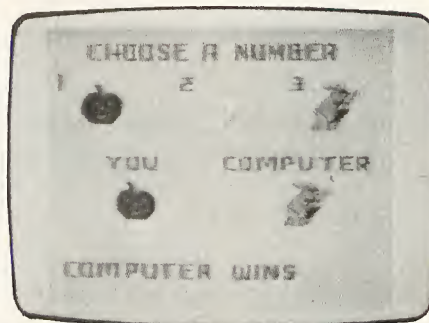


Photo. Magic Pumpkin Game Screen

Line Description			
Line 10	Dimension arrays	Lines 240–290	Credits and music
Lines 20–40	Draw strings for display section	Lines 310–320	Animation for title page
Lines 50–70	Strings for object's sounds	Lines 330–370	Instructions
Lines 80–90	Draws haunted house	Line 380	Starts play
Lines 100–110	Draws witch and stores in array	Lines 390–400	Score-keeping
Lines 120–140	Draws pumpkin and stores in array	Lines 410–460	Draws playing screen
Lines 150–160	Moves pumpkin	Line 470	Computer's choice
Lines 170–180	Draws ghost	Line 480	Player's choice
Lines 190–230	Stores ghost in array and moves ghost	Lines 490–650	Displays player's and computer's choice and determines the winner
		Lines 660–690	Option to play again
		Lines 700–740	Animated ending

Illustration by Rod McCormick

Program Listing. Magic Pumpkin

```

1 'MAGIC PUMPKIN
2 'BY GEORGE & ELLEN AFTAMONOW
10 CLEAR1500: DIMH(1,12),P(1,12),
W(1,13)
20 C$="L2HU3ER2BD5BR4 HU3ER2FD3G
NL2BR4 U4ERFND3ERFD4BR4 U5R2FDGN
L2BF2BR3 HU4BR4D4GNL2BR5 U5NL2R2
BD5BR4 U3NR2U2R3BD5NL3BR4 U5R2FD
GNL2FDBR12 HU4BR3BDD3GNLBR2NHREN
U4BDBR3 NU5BR3 U5F2DF2NU5BR4 NHR
EUHGHUERF"
30 Y$="U3NH2E2BD5BR4 HU3ER2FD3GN
L2BR5 HU4BR4D4GNL2BR16 HU4BR3BDD
3GNLBR2NHRENU4BDBR4 NU5BR4 U5F2D
F2NU5"
40 T$="U5NL2R2BR3 D5BR3 U3NR2U2R
3BD5NL3"
50 W1$="L255T255BGACCB04CGACCB05
C":W2$="T50L50O5G"
60 P1$="O1L10T10CDCF"
70 G1$="O5L15T15ADGF"
80 PMODE3,1:PCLS6:SCREEN1,1
90 DRAW"BM80,170;S16C7U4LE2R3ULE
R2E2U3LE3 F3LBLLD2RU2BRD3R2F3BL2
LNU BL4LURNDBR4RDBR2U4LE2 F3LBL
DRUBRD6 BL2D2LU2BL8D2LU2BL5D2LU2
RBR5RBR8RBR2 F2NL2D2L2NU2L8NL2U3
L2D3L10":PAINT(92,152),7,7
100 DRAW"BM12,30;S4EUNG4UNG5UNG6
UNG6 BUG7BUNE6BLNE6BUNE5BLNE5BUE
4R5 E3NE4L4H2NG3HUNG3UEUEUBGNG5
BEE3R2UR2ER HULHL2HLHLHR9FRNG5C8
DNGNDC7RDC8NLNG2RFDHLNG2DGLC7 D3
GC8F2R3C7E9DG7NG2C8DGLC7BLNG3C8L
3H3C7G4F2R5BRNE3C8R5NG8DNL6G8C7
NHGND2U2NLC8E6NEL4C7NE2G6"
110 PAINT(16,18),7,7:GET(1,0)-(3
3,32),W,G:FORW=0TO220STEP2:PUT(W
,0)-(W+32,32),W,PSET:NEXTW:FORZ=
1TO4:PLAYW1$:NEXTZ:PLAYW2$
120 DRAW"BM14,60;S4C8L4H6U9E5R4D
FRF EBD6R3D2RDL6URU2RBL3NUL4UE2F
2BR8DR4UH2G2BH5 U4H2LHR3F3D4FE R
EUR4F5D9G6L12BU4 H2U2FRFR6ERED2G
2LGL4HL"
130 PAINT(20,58),8,8
140 GET(2,34)-(34,64),P,G:FORP=2
TO84STEP2:GOSUB320:NEXTP
150 DRAW"BM66,60;S8C5U6E2F2ND2E2
F2D6BR6":FORP=86TO112STEP2:GOSUB
320:NEXTP:DRAW"BRU4NR6U2E2R2F2D6
BR10":FORP=114TO144STEP2:GOSUB32

```

```

0:NEXTP:DRAW"NR3H2U4E2R2FBD3NL2N
D4RD3GBR8"
160 FORP=146TO160STEP2:GOSUB320:
NEXTP:DRAW"NU8BR8":FORP=162TO182
STEP2:GOSUB320:NEXTP:DRAW"NR2H2U
4E2R2FBD6G":FORP=184TO220STEP2:G
OSUB320:NEXTP:PLAY P1$
170 DRAW"BM4,88;S8C5E9R3FD2NDL2D
2RNEBL2U2L2D2R2BR2G6UG2U3G3U3"
180 PAINT(14,80),5,5
190 GET(2,62)-(32,94),H,G:FORG=2
TO78STEP2:GOSUB310:NEXTG
200 DRAW"BM60,96;C5U8R6D4L4D4NL2
BR8":FORG=80TO96STEP2:GOSUB310:N
EXTG:DRAW"NR6U8BR6D8BR4":FORG=98
TO116STEP2:GOSUB310:NEXTG
210 DRAW"U8F3ND2E3D8BR5":FORG=11
8TO136STEP2:GOSUB310:NEXTG:DRAW"
U8R6D4L4D4NL2BR8":FORG=138TO156S
TEP2:GOSUB310:NEXTG
220 DRAW"U8BR5G4NLF4BR5":FORG=15
8TO176STEP2:GOSUB310:NEXTG:DRAW"
NU8BR4":FORG=178TO196STEP2:GOSUB
310:NEXTG
230 DRAW"U8F3D2F3U8":FORG=198TO2
20STEP2:GOSUB310:NEXTG:PLAY G1$
240 PCLS:PMODE4,1:SCREEN1,1
250 DRAW"BM70,70;C5S8E2NE2D2R2 E
2U2R2D4R2 E2U2L2D2F2R2 U2E2R2D2G
2NL2BR4NH2 E2U4BG2R4BG2F2R2 E2U2
L2D2F2R2 U2E2NU2D4NL2RBR8 E4U2L2
D4NR2D2R2NU2R3NU2R2NU2D4L"
260 DRAW"BM40,100;S16E2U2LD5RNU2
BG2FEU2REULDFR2 HEFGREURD2R UNFE
FDNLBG2FEU2REULDFBR5"
270 DRAW"NR2UNRURNUNRBD2NDRBR6 N
R3HURNRHUEFREBD5 E3U2LD4FE3U2LD4
FR EULDFEURND2RD2R"
280 DRAW"BM74,150;S16EUR2HLNDU2E
FD5R E2U3LD5ND3R E2BHRNRNU2D3R N
RUERDNGFR U2RND2RND2RD2R ENDURNR
DBGR2UNLNUR URND2RD2R NR2U2RNRDR
NDNUE D2RNURU2R"
290 PLAY"T3O2L8.CL16DL8.CL16DL8.
EL16GL8.AL16GL8.AL16BO3L8.DL16CO
2L8.BO3L16DL8.CO2L16AL8.GL16GO3L
8.CO2L16CL4DGL1C"
300 GOTO330
310 PUT(G,62)-(G+30,94),H,PSET:R
ETURN

```

♦ to page 22

Telewriter-64TM

the Color Computer Word Processor

- 3 display formats: 51/64/85 columns × 24 lines
- True lower case characters
- User-friendly full-screen editor
- Right justification
- Easy hyphenation
- Drives any printer
- Embedded format and control codes
- Runs in 16K, 32K, or 64K
- Menu-driven disk and cassette I/O
- No hardware modifications required

THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...

— Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPV/II/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Termimet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

*...truly a state of the art word processor...
outstanding in every respect.*

— The RAINBOW, Jan. 1982

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs \$49.95 on cassette, \$59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

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Del Mar, CA 92014

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

(Add \$2 for shipping. Californians add 6% state tax. Allow 2 weeks for personal checks. Send self-addressed stamped envelope for Telewriter reviews from CCN, RAINBOW, 80-Micro, 80-U.S. Telewriter owners: send SASE or call for information on upgrading to Telewriter-64. Telewriter-compatible spelling checker (Spell 'n Fix) and Smart Terminal program (Colorcom/E) also available. Call or write for more information.)

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COLOR COMPUTER SOFTWARE

COMPLETE YOUR WORD PROCESSOR

SPELL—RITE

THE Cassette Spelling Verifier

You've got the best word processor. Now complete your system with the best spelling verifier. Spell-Rite is a convenient, fast way to insure that all of your documents are letter perfect. Spell-Rite was designed specifically for cassette-based word processors. Like Yours!

Spell-Rite is easy to use, completely menu driven.

Spell-Rite is Fast! You can verify a 1000 word document in under 9 minutes - including cassette I/O.

Spell-Rite is complete. It comes with its own 10,000+ word dictionary which you can expand. Also included is a superb manual.

Spell-Rite works with any word processor that generates ASCII tape files, such as Color Scribes, Super Color Writer and Telewriter 64. 32K of RAM and Extended Basic are required.

Cassettes and manual \$59.95

DISK BASIC AID

DISK BASIC
MADE BETTER

Your Color Disk Basic is one of the most powerful Basics on any computer. Add Disk Basic Aid and it also becomes one of the easiest to use! The Basic Aid package will make developing and entering Basic programs a snap. Here are just *SOME* of the great features Basic Aid contains.

- Full Screen Editing
- Automatic Line Numbering
- 2 Key entry of Basic keywords
- Cross Reference
- Automatic Key Repeat
- User definable keys

PLUS. Label support! This unique Basic Aid feature is a vast improvement in the Basic language. Label any line you want and use that label in all calls to that line. Forget about line numbers, just call routines by name like this:

"ON A GOTO ENTERCHECKS, PAYABLES, EXIT"

A real time saver. And for transportability Basic Aid will convert all labels to line numbers.

These and other great features make Basic Aid a 'must' for anyone who writes or modifies Basic programs. Basic Aid runs on 32K or 64K Disk systems. It comes with complete documentation and our new, heavy duty keyboard overlay.

Disk Basic Aid \$49.95

SPECTRUM — STICK

Put the joy back into color computing with the Spectrum Stick. This heavy duty joystick gives you a true feel of control. And it comes with an extra long cable and power on/off LED.

"...the feeling of this joystick is superb" March 1983, 80-Micro
TX: add sales tax \$39.95

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Name _____

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C _____

M _____

♦ from page 20

```

320 PUT(P,34)-(P+32,64),P,PSET:R
RETURN
330 CLS:INPUT"DO YOU NEED INSTRU
CTIONS (Y/N)";IS
340 IFIS="N"THEN380ELSEIFI$="Y"
THEN350ELSE330
350 CLS:PRINT"THE COMPUTER WILL
RANDOMLY PICK A GHOST, PUMPKIN O
R WITCH.":PRINT:PRINT"THE OBJECT
IS FOR YOU TO PICK ONE OF THE
THREE THAT WILL BEAT THE COMPUT
ER'S CHOICE.":PRINT:PRINT"THE WI
TCH EATS THE PUMPKIN FOR AWIN."
360 PRINT"THE PUMPKIN WILL EXORC
ISE THE GHOST FOR A WIN.":PRIN
T"THE GHOST WILL SCARE THE WITCH
FOR A WIN.":PRINT
370 INPUT"PRESS 'ENTER' TO START
";IS
380 CLSRND(8):INPUT"HOW MANY ROU
NDS";N:GOTO410
390 CLSRND(8):NU=NU+1:IFNU=N THE
NPRINT@44,"FINAL";
400 PRINT@76,"SCORE";:PRINT@160,
"YOU=";Y;:PRINT@256,"COMPUTER=";
C;:PRINT@352,"TIE=";T;:FORR=1TO1
500:NEXTR:IFNU=N THEN660
410 PMODE3,1:PCLS6:SCREEN1,1
420 DRAW"BM40,20S8L2HU3ER2BD5BR3
U5BR4D3NL3D2BR3 HU3ER2FD3GNL2BR
4 HU3ER2FD3GNL2BR5 NHREUHGHERFB
D4BR3 U3NR2U2R3BD5NL3BR8 U4ER2FD
2NL4D2BR9"
430 DRAW"U5F2DF2NU5BR3 HU4BR4D4G
NL2BR4 U4EFND3EFD4BR3 U5R2FDLNL2
FD2NL3BR3 U3NR2U2R3BD5NL3BR3 U5R
2FDGNL2FD"
440 DRAW"BM12,40;S8U5":PUT(24,36
)-(56,66),P,PSET
450 DRAW"BM100,40;S8NR3U2R3U2L3"
:PUT(112,36)-(142,68),H,PSET
460 DRAW"BM184,40;S8R3UHNLRUHL2"
:PUT(196,36)-(228,66),W,PSET
470 X=RND(3):A=48:B=100
480 K$=INKEY$:IFK$="1" THEN490EL
SE IFK$="2" THEN530ELSE IFK$="3"
THEN570ELSE480
490 GOSUB620:GOSUB650:A=176
500 IFX=2 THENGOSUB630:DRAW"BM60
,168;" +Y$:Y=Y+1:GOSUB610:GOTO390
510 IFX=3 THENGOSUB640:DRAW"BM20
,168;" +C$:C=C+1:GOSUB610:GOTO390
520 IFX=1 THENGOSUB650:DRAW"BM80
,168;" +T$:T=T+1:GOSUB610:GOTO390

```



```

530 GOSUB620:GOSUB630:A=176
540 IFX=1 THENGOSUB650:DRAW"BM20
,168;" +C$:C=C+1:GOSUB610:GOTO390
550 IFX=2 THENGOSUB630:DRAW"BM80
,168;" +T$:T=T+1:GOSUB610:GOTO390
560 IFX=3 THENGOSUB640:DRAW"BM60
,168;" +Y$:Y=Y+1:GOSUB610:GOTO390
570 GOSUB620:GOSUB640:A=176
580 IFX=1 THENGOSUB650:DRAW"BM60
,168;" +Y$:Y=Y+1:GOSUB610:GOTO390
590 IFX=2 THENGOSUB630:DRAW"BM20
,168;" +C$:C=C+1:GOSUB610:GOTO390
600 IFX=3 THENGOSUB640:DRAW"BM80
,168;" +T$:T=T+1:GOSUB610:GOTO390
610 FORR=1TO1500:NEXTR:RETURN
620 DRAW"BM52,92;S8U2NH2E2BD4BR4
HU2ER2FD2GNL2BR4 HU3BR4D3GNL2BR
":DRAW"BM140,92;S8L2HU2ER2BD4BR4
HU2ER2FD2GNL2BR4 U3ERFND2ERFD3B
R3 U4R2FDNL3BD2BR4 HU3BR4D3GBR2B
R5 U4NL2R2BD4BR3 NR3U2NR2U2R3BR3
ND4R2FDL2NF2L":RETURN
630 PUT(A,B)-(A+30,B+32),H,PSET:
PLAYG1$:RETURN
640 PUT(A,B)-(A+32,B+30),W,PSET:
FORZ=1TO4:PLAYW1$:NEXTZ:PLAYW2$:
RETURN
650 PUT(A,B)-(A+32,B+30),P,PSET:
PLAYP1$:RETURN
660 CLS0:PRINT@192," DO YOU WANT
TO PLAY SOME MORE (Y/N) ";:IN
PUTI$
670 IFI$="Y" THEN NU=0:T=0:Y=0:C
=0:GOTO380
680 CLS0:PRINT@192," AW C'MON, J
UST ONE MORE GAME? (Y/N) ";:IN
PUTI$:IFI$="Y" THEN NU=0:T=0:Y=0
:C=0:GOTO380
690 IFI$="N" THEN700ELSE680
700 CLS8:PRINT@235,"THE";+CHR$(2
55);+"DEN";:FORX=1TO700:NEXTX
710 FORX=207TO143STEP-32:PRINT@X
,"D";:PRINT@X+32,CHR$(255);:SOUN
DX,3:NEXTX
720 FORX=144TO146:PRINT@X,"D";:P
RINT@X-1,CHR$(255);:SOUNDX,3:NEX
TX
730 FORX=178TO245STEP32:PRINT@X
,"D";:PRINT@X-32,CHR$(255);:SOUN
D
X,3:NEXTX
740 GOTO740

```

Color Computer Flex* OS-9† Users Move up to C Language Compiler

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A New Machine

The new Color Computer didn't really spring forth fully programmed from a pumpkin, but it — and a cousin — really are here!

by Kerry Leichtman, Editor

MY COLOR COMPUTER has been replaced. I no longer sit in front of a Mercedes silver console. My fingers may never touch that controversial keyboard again. No, I didn't buy an Apple (perish the thought)!

My new computer is the same size as my old machine. It fits neatly into the space occupied by my displaced Color Computer. It uses virtually all my Color Computer software. It even connects to all of my Color Computer peripherals, including Radio Shack's new Multi-pak Interface and Amdek III three-inch disk drives. None of this compatibility surprises me — my new computer is Radio Shack's new Color Computer.

There is no new name to distinguish it from its former incarnation. It is, simply, the Color Computer.

There *are* differences between the two models. The new Color Computer comes in a white case, similar to the TDP-100. I have never found the Color Computer's keyboard to be a hindrance, but I am not a touch-typist. My method is a very fast self-taught style, requiring my eyes to be glued to the keyboard. People who type better tell me the Color Computer's keyboard is a real nuisance. For those of you who know typing: Radio Shack has done you solid — the new Color Computer comes with a sculptured keyboard.

The keyboard is not just a reworked Model III version, it's the Color Computer's own, and I have to say, this one's a honey. My not-so-nimble fingers fly across its surface. The plastic keys click when depressed (not emotionally) so I know if I pressed one by mistake.

There's another immediately noticeable change. The plastic Radio Shack logo tag not only states the manufacturer (Radio Shack) and the name of the computer (TRS-80 Color Computer), it also states RAM size (64K!)! Yep, for those of you patiently waiting for the official Radio Shack 64K version of the Color Computer, your wait is over — 64K is here, and in style too. A few days after my new computer arrived, so did the OS-9 Disk Operating System (DOS).

OS-9 gives you full use of the 64K disk-based Color Computer. The Color Computer's new DOS is based on the widely used UNIX operating system, which is a product of Bell Laboratories. The DOS includes many features, including a text editor, assembler, debugger, and other worthy features. We'll be able to give you an in-depth account after we've had a chance to live with it for a few weeks.

Let's open the Color Computer up and peek at its innards. The most noticeable thing is, once again, the keyboard. It's attached to the circuit board by the latest "connectorless" ribbon cable. Of course, there is 64K of RAM. Aside from these differences, there are no other obvious major changes. We noticed a new capacitor here and there, but that's all.



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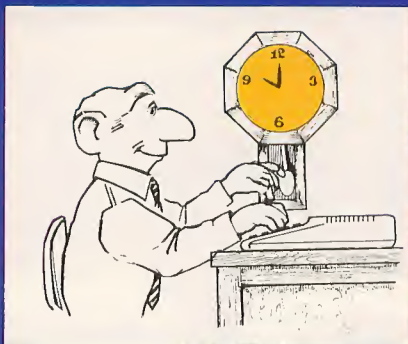
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The Multi-pak Interface

The ROM has been revised and *up*-dated. This change is more of a debugging and house-cleaning change than a major difference. All your Color Computer software will work on the new machine.

Multi-pak Interface

Radio Shack's Multi-pak Interface is a neat little gadget. It attaches directly to the ROMpak port of your Color Computer without cables. Unfortunately, it means that my Color Computer Workstation will have to undergo a cosmetic operation to allow the hook-up.

The interface is a grey plastic box-shaped peripheral with slots on top for four ROMpaks. A switch on the front of the interface lets you switch from one slot to another. This saves you wear and tear on the contacts of your ROMpaks and the ROMpak port of your Color Computer. I keep my disk controller in slot four and vary the contents of the other slots.

Slot selection can also be software directed. (The manual lists the POKes necessary.) This aspect broadens the possibilities of this new piece of hardware. Imagine a program that draws upon other programs to produce a multi-program display! You could have sound routines work off one slot, graphics off another, and so on. I've been trying to write a routine that will give my Poltergeist feet Canyon Climber's jumping ability. That way I can jump over the nasties on the staircase and save poor Carol Anne. (I'll let you know when I've got it worked out!)

It's been quite a month, beginning with the introduction of the MC-10, then moving on to the Multi-pak Interface, the Color Computer, and finally OS-9. What's next from Tandy? Quite a bit, and you won't have to wait long to find out.



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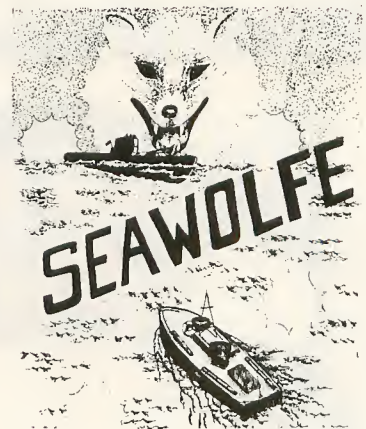
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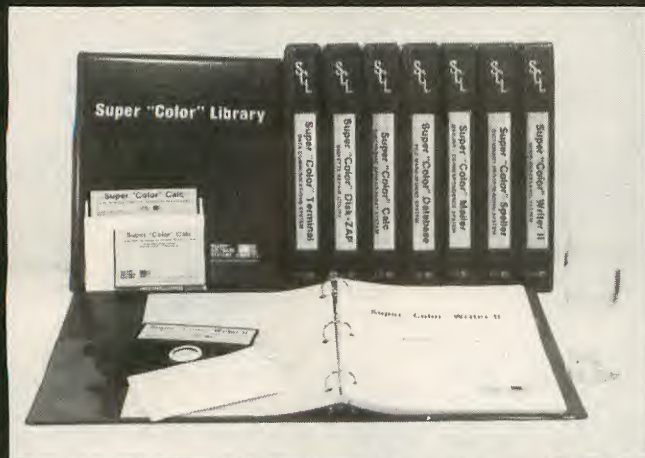


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Custom Color

Here it is — 64K upgrade, at last!

by Dennis Kitz

Learning the ABC's

TWO MONTHS of heavy-duty projects are enough, I say! This month's column contains some sweet, simple customizing for your Color Computer: a description of the major revisions, plus why and how they differ, how to do 64K upgrades, and all you need to hook up a nifty full-sized keyboard for \$20 or less.

The world of the Color Computer is in turmoil. As I write this, Radio Shack has informed its stores that the present line of Color Computers—16K and 32K Basic and Extended Basic—is "SOWG" (sold out when gone). The replacement, an upgraded version of all Basics with 64K RAM, is not yet official. Present owners are not abandoned, however; the new machine, I am told, is virtually a "work-alike," representing a consolidation of the different Color Computers, reflecting changes in memory and parts cost. It seems to make sense. Remember 4K RAM? 4K machines disappeared when new 16K memories for production began to cost less than 4K RAMs! Because of demand, the price curves crossed—four bytes for the price of one. And as quantity cost of 64K memory chips now crowds the 16K parts, it makes economic sense for Radio Shack to include as much memory as possible as a selling point.

So with that imminent change in mind, I feel that now is a good time to look inside the two major Color Computer designs already produced by Radio Shack.

In general, electronic devices are designed to carry out certain functions—amplifying, recording, calculating, whatever. Each product usually originates from a set of functional goals or general specifications which engineers and marketing people work together to organize and select. The engineers then begin work assembling a hand-made, functioning model that meets those goals; this is the prototype. In computer design, software engineers join the team that constructs the prototype.

If the design goals are reasonably simple—such as with the Color Computer—the early stages can be quite short. When the electronic design is completed, the physical layouts can begin, including circuit boards, keyboards, cases, connectors, cords, transformers, electronic parts, screws, knobs, switches, labels, faceplates, doors and springs. During this process the parts buyers are called in to assure that every component specified can be obtained in proper quantities and at a good price. Sometimes design changes can result not only from availability problems as well as minor glitches or inconveniences in the computer's operation, but also from government regulation and testing by underwriters.

Software and hardware are consolidated, and the first versions begin to appear in-house: operating software version 1.0 and schematic and circuit board

layout revision A. The progress of a prototype from conception to revision A can be seen in Photos 1 through 4—the Low-erkit presented last month. An excellent book about high-powered design teams working on their prototypes is Tracy Kidder's *The Soul of a New Machine*.

Because software is more accessible to the user, and since slight changes can make major differences in its relationship to other software, it is provided with the decimal-style version number. The two sides of the version number's decimal point offer distinct meanings. A number change on the left side usually indicates a major overhaul of the software (it means: Warning! Nothing is like it was! Expect the unexpected!), whereas the right side points to some brushing up or debugging (it means: Sorry, let me pluck this fly out of your soup.).

Hardware revisions are deliberately less significant to the user because, unlike software authors, electronic designers work under more severe economic and performance constraints. They must create a machine that in every respect works like the previous version; they may revise only occasionally because of the production costs involved in making new printed circuit boards; and they may cause no added expense through parts supply problems, packaging redesign, or assembly line changes.

These restrictions are not always met in either hardware or software. PET owners know this too well: its Basic changed

♦ next page

noticeably in each version, and its hardware was altered regularly.

Radio Shack has worked hard on the compatibility issue. Its Model I/III/4 and Model II/16 series are excellent examples of growth without disruption. The Color Computer has followed that course, and promises to continue. To date, the revisions listed in Table I exist.

Those early C-revisions, virtually prototypes in themselves with internal cables and wire jumpers, were few and far between. The debugged D boards occupied the first year of production, followed by E boards when the easier 32K

upgrade (using 64K chips) became popular. During these revisions, the TDP-100 was developed—essentially a Color Computer with a different case. Inside, though, rested the NC circuit board. Once again, in a move to consolidate production, Radio Shack selected the NC board as the Color Computer standard, with its full 64K upgrade possibilities.

Figures 1 and 2 are a tour of the inside of revision D and revision NC. Copy these or cut them out for future reference; whenever you read of a modification or upgrade you would like to try, these layouts will help.

64K At Last

I've been hesitating about this upgrade because, unlike other computers, there are two major ways to do it. Have a look at Figure 3. The memory map of the 6809 processor is like that of any other standard 8-bit device: 64K of memory, in whatever form, is permitted. However, the addition of the Synchronous Address Multiplexer (SAM) expands this total memory capacity to 96K; the bottom 32K of address space can be bank-switched between two blocks of RAM. The advantage: Basic is not lost. The disadvantage: only one bank is on line at a time.

(Usually I recommend an upgrade or modification because I find distinct advantages to it, or because I am enthusiastic about its possibilities. To either 64K expansion I am neutral. Because I use so little memory in most applications, the advantages and disadvantages have little import for me. Since I have been deluged with mail, I present the second, more popular upgrade.)

64K Upgrade, Radio Shack style—Rev. NC and TDP-100. Needed: Phillips screwdriver to open the case, eight 64K RAMs (type 4164/4864).

1. Unplug and open the computer.
2. Remove the RF interference shield by pulling straight up, firmly.
3. Move three jumpers (one above U27 and U28, two left of U21) by lifting up and moving over to the 64K position.
4. Solder or jumper together the two staking pins between U16 and U17. For greatest reliability, use a 33-ohm resistor or ferrite bead in place of direct connection.
5. Clip out capacitors C58, C60, C62, C64, C66, C68, C70 and C72.
6. Remove the eight 16K memories U21 through U28.
7. Install the eight 64K memories in the same direction.
8. Restore the interference shield (bend the metal tabs underneath to hold it), replace the cover, and apply power.
9. PRINT MEM should reveal a 32K machine.

64K Upgrade, Radio Shack style—Rev. E. Needed: screwdriver to open the case, snips, solder and iron, thin wire, eight 64K RAMs (type 4164/4864).

1. Unplug and open the computer.
2. Remove the RF interference shield by cutting the white plastic straps and working the cover around its edges.
3. Move four jumpers (one between U4 and U8, and three above the key-

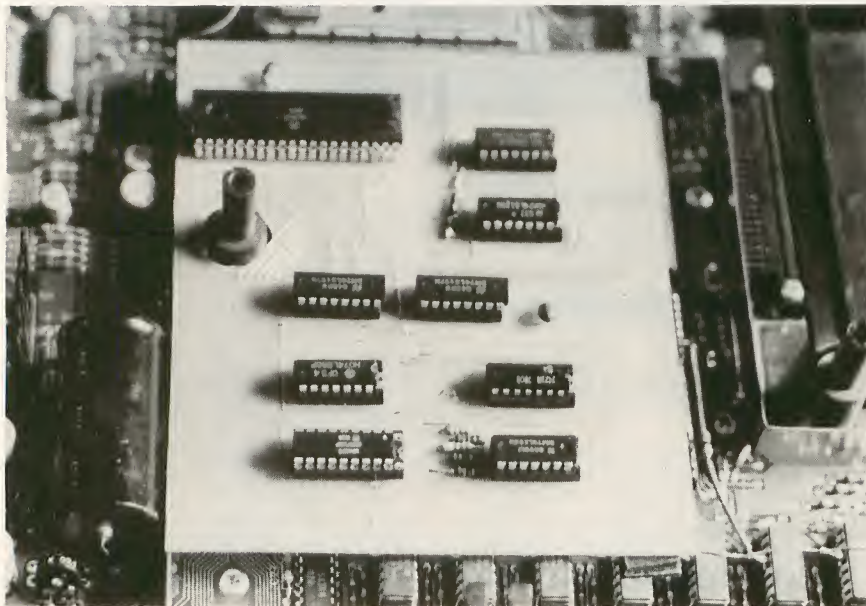


Photo 1. Initial development of a Lowerkit results in a single-sided, very large prototype. It works.

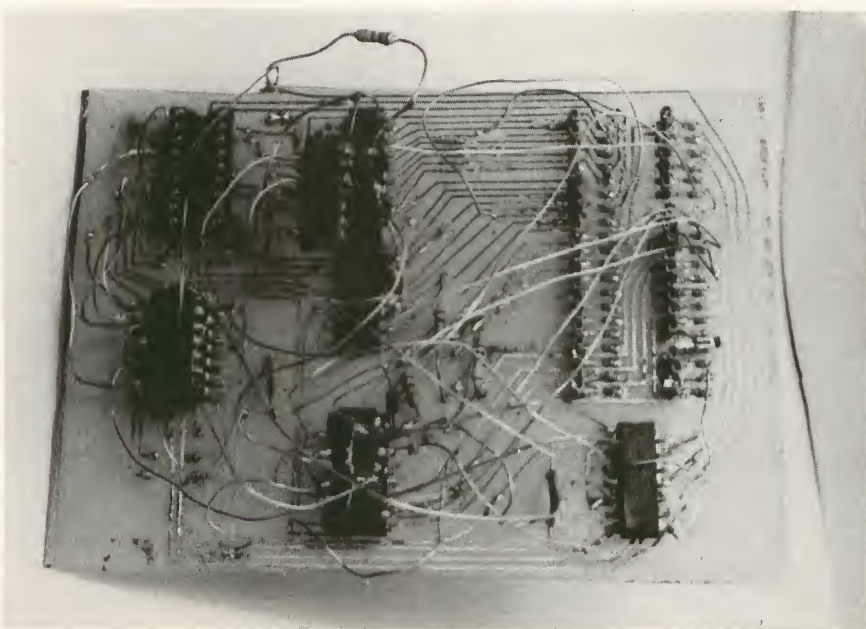


Photo 2. First compact, double-sided version is replete with errors.

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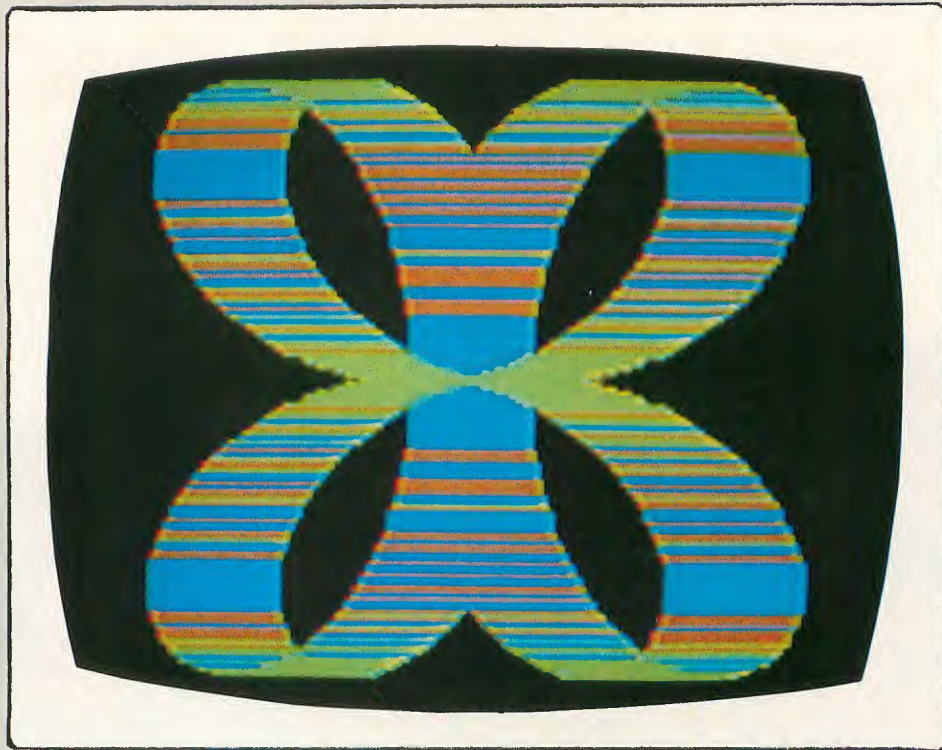
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♦ from page 32

board connector) up and over to the 32K position.

4. Move the remaining jumper (below C44) up and over to the 16/32K position.

5. Solder or jumper together the two staking pins to the left of C44. Preferably, connect these through a 33-ohm resistor or ferrite bead.

6. Solder or jumper together the two LO staking pins next to U29.

7. Carefully remove U29 from its socket, and bend pins 4, 5 and 6 up and parallel to its body.

8. Remove U11 from its socket, and bend pin 5 up and parallel to its body.

9. Replace U29 and U11 in their sockets, except for the pins noted.

10. Connect three wires: from U29 pin 6 to U29 pin 8; from U29 pin 4 to U11 pin 5; from U29 pin 5 to TP1.

11. Clip out capacitors C61, C31, C64, C35, C67, C45, C70 and C48.

12. Remove the eight 4K or 16K memory chips U20 through U27.

13. Install eight 64K memory chips, pointing in the same direction.

14. Restore the interference shield and press it down, replace the cover, and power up.

15. PRINT MEM should reveal a 32K machine.

64K Upgrade, Radio Shack style—Rev. D. Needed: screwdriver to open the case, snips, solder and iron, sharp cutting tool, thin wire, eight 64K RAMs type 4164/4864.

1. Unplug and open the computer.

2. Remove the RF interference shield by cutting the plastic straps and working the cover around its edges.

3. Move the jumper found at the right of U10 up and over to the 16K position.

4. Remove the jumper between U4 and U8. There are three trace cuts to make. Remove all the screws that hold the circuit board in place, and the three screws holding the power supply. Pull off the five power-supply wires from the circuit board; keep track of where they go. Remove the three wires leading from the power cord to the power supply; make note of where they go. Pull the keyboard connector out of the header, and set aside the keyboard. Lift out the power supply, then the circuit board. Use a pencil eraser to press out the rivets holding the metal shield in place. Hold the board face down with the keyboard connector toward you. There are five heavy circuit traces running parallel to the front of the board underneath the RAM sockets, three to the front and two to the back. Call the frontmost trace number 1, and the backmost number 5. All trace cutting is done to the right of U27 as you are looking now from the back.

5. Cut the +5 volt trace running to RAMs pin 9. This is trace number 2.

6. Cut the +12 volt trace running to RAMs pin 8. This is trace number 3.

7. Cut the -5 volt trace running to RAMs pin 1. This is trace number 5. Now make these jumpers:

8. From the right side of trace number 2 (+5 volts) to the left side of trace number 5 (RAM pin 1).

9. From the right side of trace number 2 (+5 volts) to the left side of trace number 2 (RAM pin 8).

10. From U35 pin 10 to the left side of trace number 3 (RAM pin 9).

11. Remove U29 from its socket. If it is not in a socket, you have two choices:

you may desolder the integrated circuit from the bottom, or you can carefully clip the required pins at the circuit board surface, bending the remaining stubs up and away from the board.

12. Bend pins 4, 5 and 6 of U29 up and parallel with its body.

13. Remove U11 from its socket and bend pin 5 up and parallel with its body.

14. Replace U29 and U11 in their sockets, except for the noted pins.

There are four jumper wires to install.

15. From U4 pin 12 to U8 pin 16.

16. From U29 pin 6 to U29 pin 8.

17. From U29 pin 4 to U11 pin 5.

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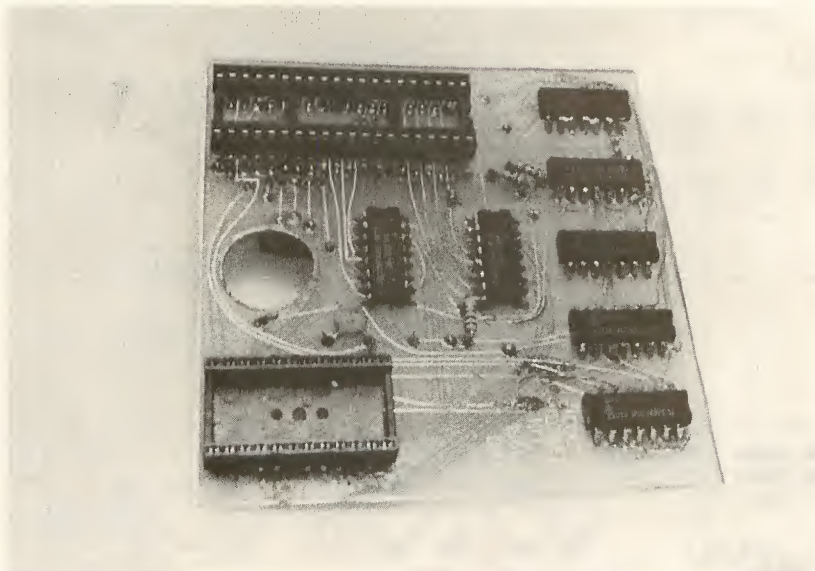


Photo 3. Second double-sided prototype looks good, with only a few minor touch-ups.

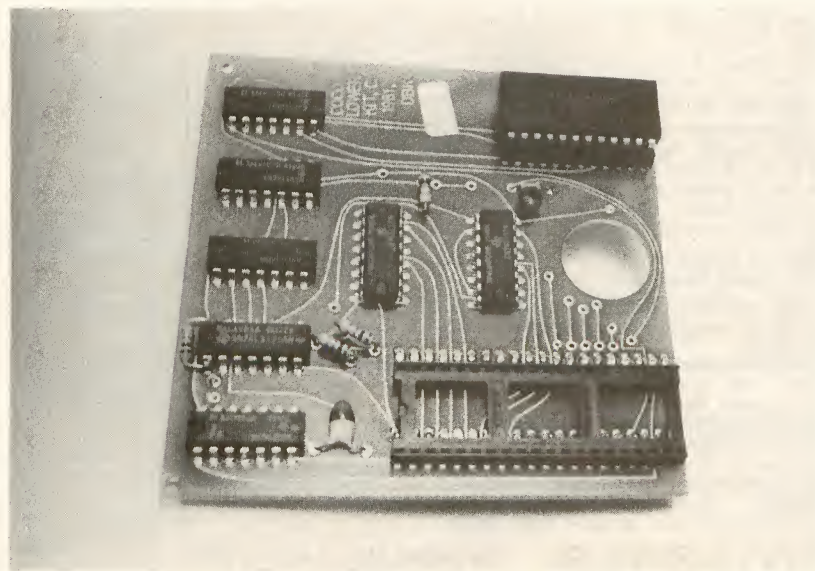


Photo 4. First production version — made useless by a change in manufacturer specifications.

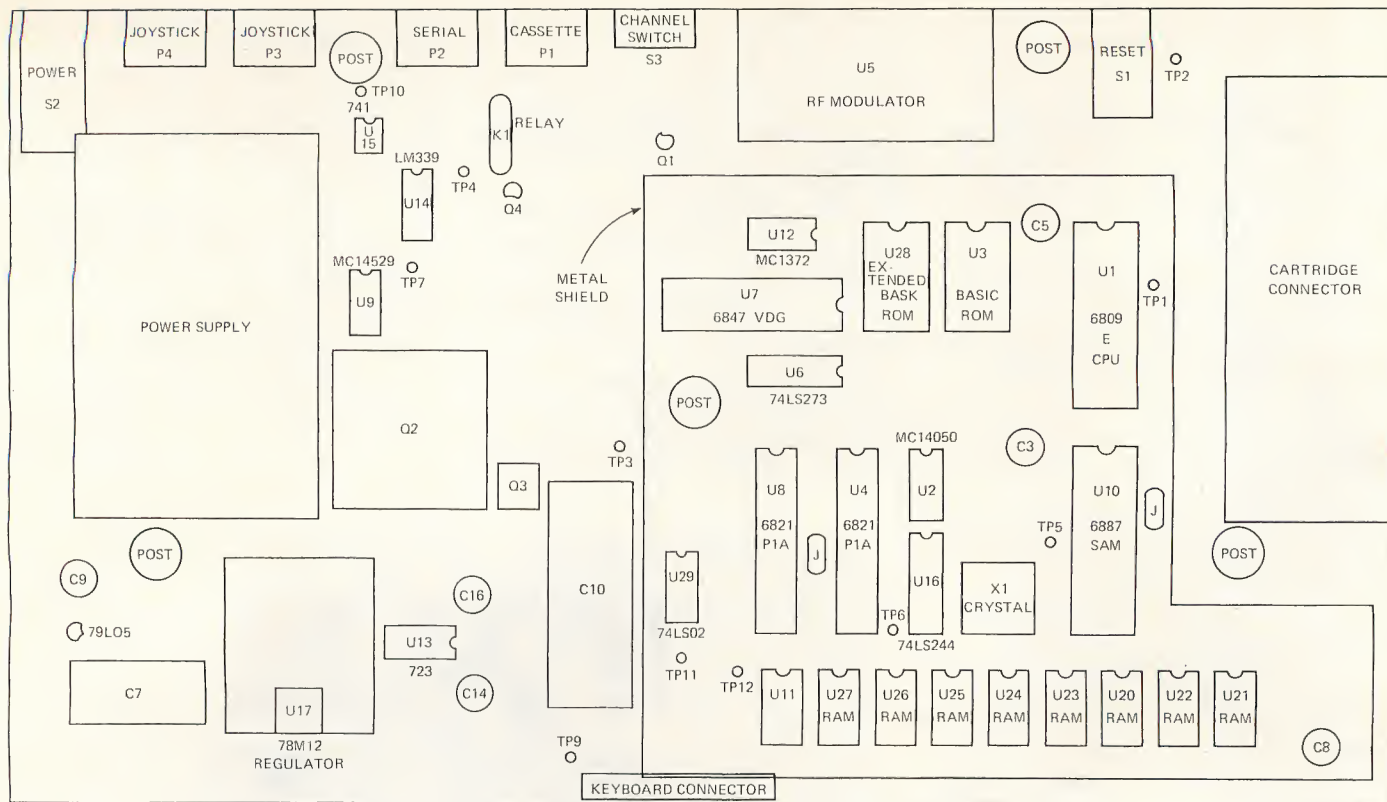


Figure 1. Board layout of Color Computers, Rev. C through Rev. E. Minor differences concern jumpers and piggybacking of integrated circuits.

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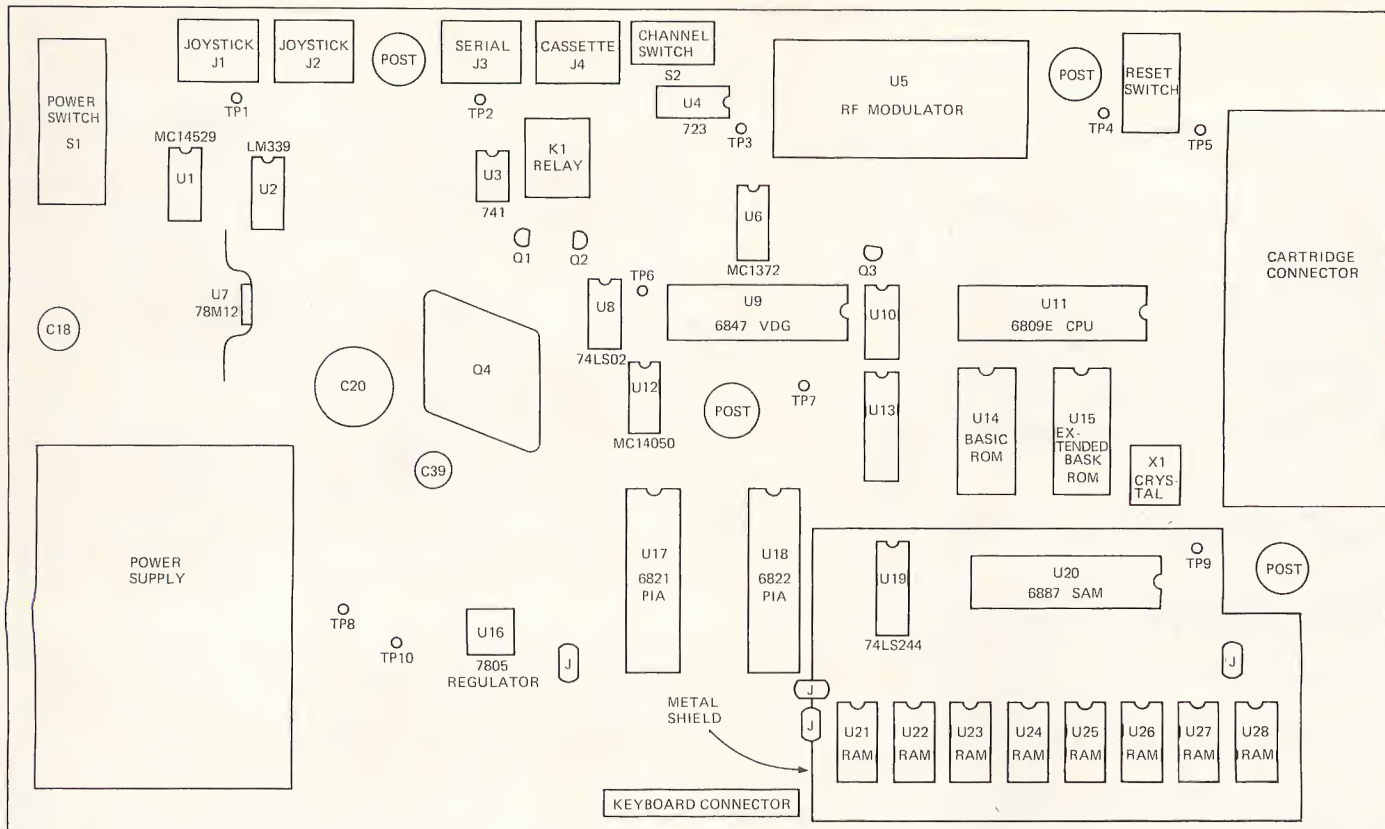


Figure 2. Board layout of Color Computers, Rev. NC, and TDP-100.

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♦ from page 35

18. From U29 pin 5 to TP1 (or U1 pin 32).
19. Remove eight 4K or 16K memories from sockets U20 through U27.
20. Insert eight 64K memories, pointing in the same direction, in sockets U20 through U27.
21. Clip out capacitors C63, C31, C64, C35, C67, C45, C70 and C48.
22. Replace U3 with a Basic 1.1 ROM.
23. Restore the interference shield, replace the cover, and power up.
24. PRINT MEM should reveal a 32K machine.

What have you done? You have removed the power (+12 and -5 volts) not needed by the more advanced 64K RAMs. You have connected a control signal that informs 1.1 Basic that 64K RAMs are connected. You have provided for memory access by adding address line A7. And you have provided a memory map selection signal for 64K (see Figure 3).

The other technique is to swap the Basic ROM with RAM. Machine language software can then access the full, contiguous memory map. The advantage: 64K of memory is present at all times. The disadvantage: Basic cannot be used.

♦ to page 40

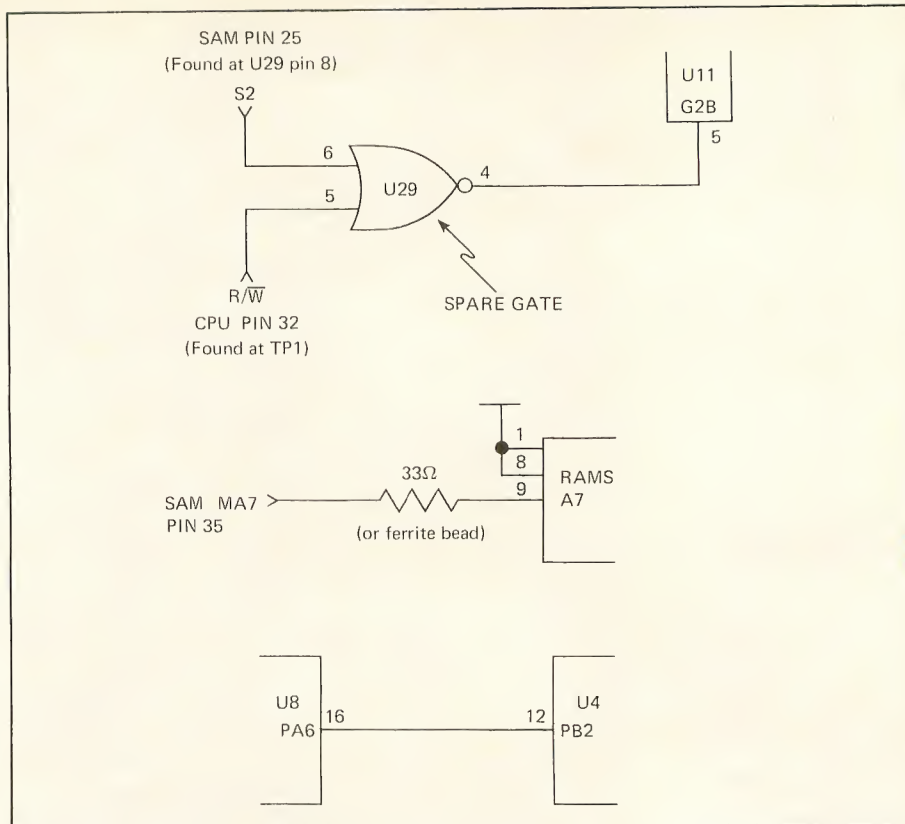


Figure 3. Changes for converting from 16K to 64K. Later computers make the changes using built-in jumpers; earlier machines require trace cutting and soldering.

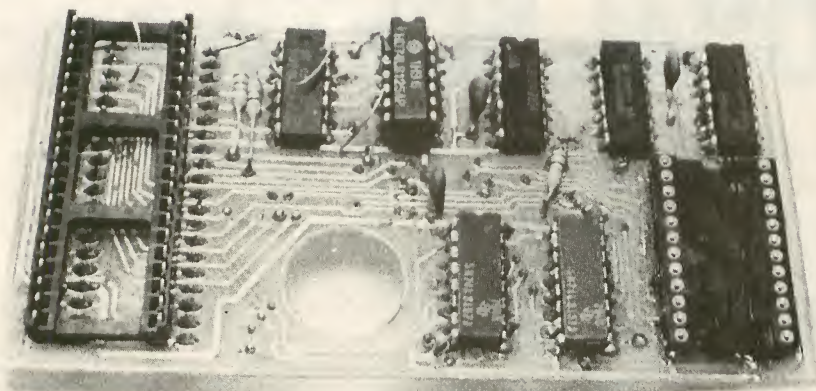


Photo 5. New prototype starts from the ground up, including a new shape; there are few errors.

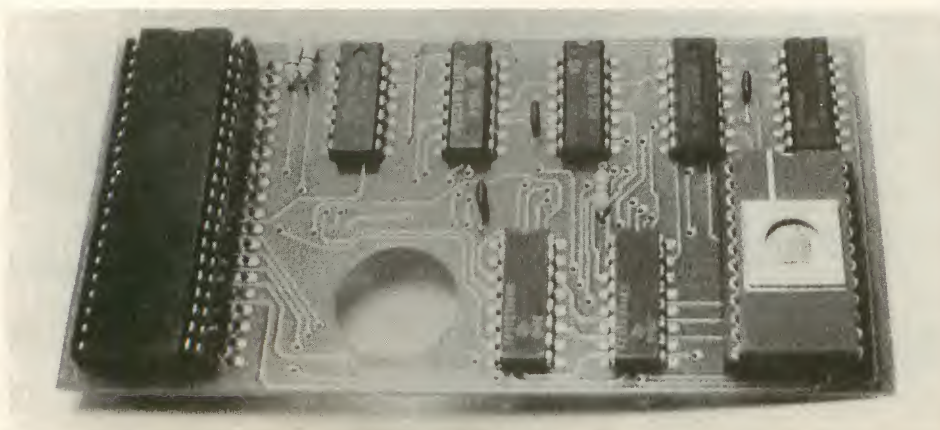
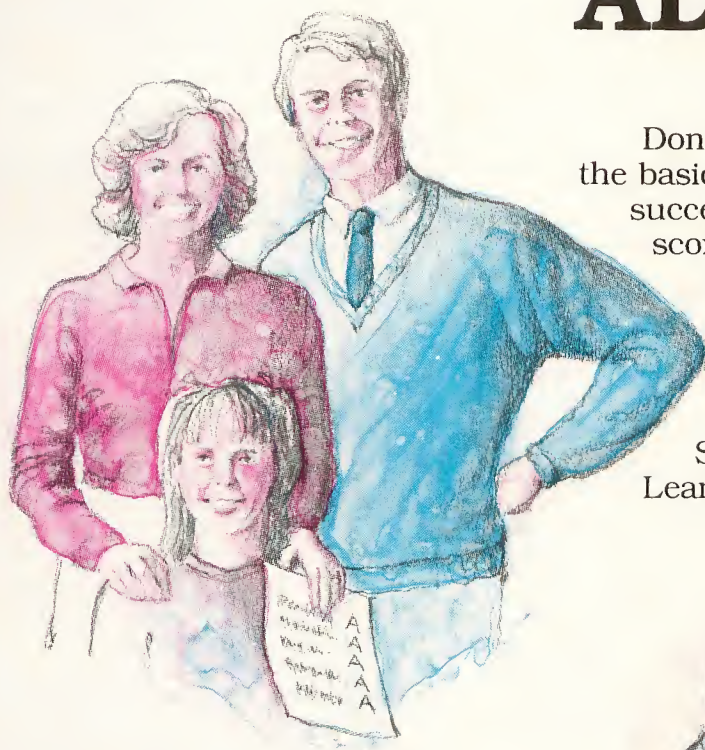


Photo 6. Second production version looks handsome.

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Choosing a New Keyboard

Among the most popular Color Computer modifications I ever described was an updated keyboard to replace those sticky little square buttons. I pulled an old Model I keyboard from a Radio Shack repair center, and made it fit. The Shack was run out of old keyboards within a month of that article, and now "professional" keyboard kits are appearing everywhere, from \$50 to \$100. You, too, can have one, with some work, of course, for as little as \$20.

There are several ways to go. A few Radio Shack repair centers still have those 53-key Model I keyboards, *but* they are few and far between. The part number is Hi-Tek #1700070, and it will probably cost you about \$20 for the trouble. Another route is the \$34.95 Jameco keyboard (#K62), 62 keys and very similar to the Color Computer arrangement. Finally, Advanced Computer Products has an abundant stock of classy 58-key units for only \$19.95, reduced from \$29.95 in their last catalog. These have just one problem: the Return (Enter) key is awkwardly placed in the old mainframe position, at the end of the second row. Figures 4 to 6 show the patterns for each keyboard.

Radio Shack has labeled the standard Return key with Enter, the Escape key with an up arrow, the Tab key with a right arrow, and the rub-out (backspace) key with a left arrow. The Control and/or Line Feed keys are replaced with only the down arrow, depending on the software. Choice of actual hook-up depends on the characters desired; more on that later.

to page 42

```

1 2 3 4 5 6 7 8 9 0 : - <BREAK>
<UA> Q W E R T Y U I O P @ <LA> <RA>
<DA> A S D F G H J K L ; <ENTER> <CLR>
<SHIFT> Z X C V B N M , . ? <SHIFT>
< SPACE >

```

Figure 4. Keyboard layout of Model I.

```

<ESC> 1 2 3 4 5 6 7 8 9 0 = <CT> <TL>
<TAB> Q W E R T Y U I O P <LB> @ <LF> <DEL>
<CTL> <CPS> A S D F G H J K L ; * <RB> <RETURN>
< > <SHIFT> Z X C V B N M , . ? <SHIFT> <REP> < >
< SPACE >

```

Figure 5. Layout of Jameco Keyboard.

```

1 2 3 4 5 6 7 8 9 0 * = <LB> <RB>
<ESC> Q W E R T Y U I O P : <TL> <LF> <RETURN>
<CPS> A S D F G H J K L ; @ <SEP> <RUBOUT>
<SHIFT> Z X C V B N M , . ? <SHIFT> <CLR>
<CTL> < SPACE > <CTL>

```

Figure 6. Layout of Advanced Computer Products keyboard.



Photo 7. Advanced Computer Products Keyboard is full-size, and just \$20.

Who says all the good games are for somebody else's computer?

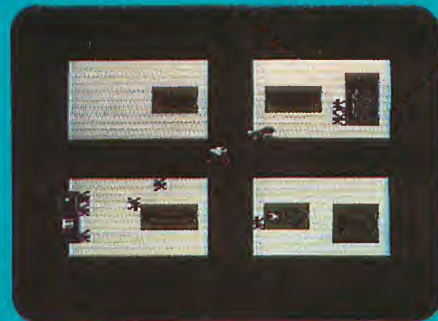
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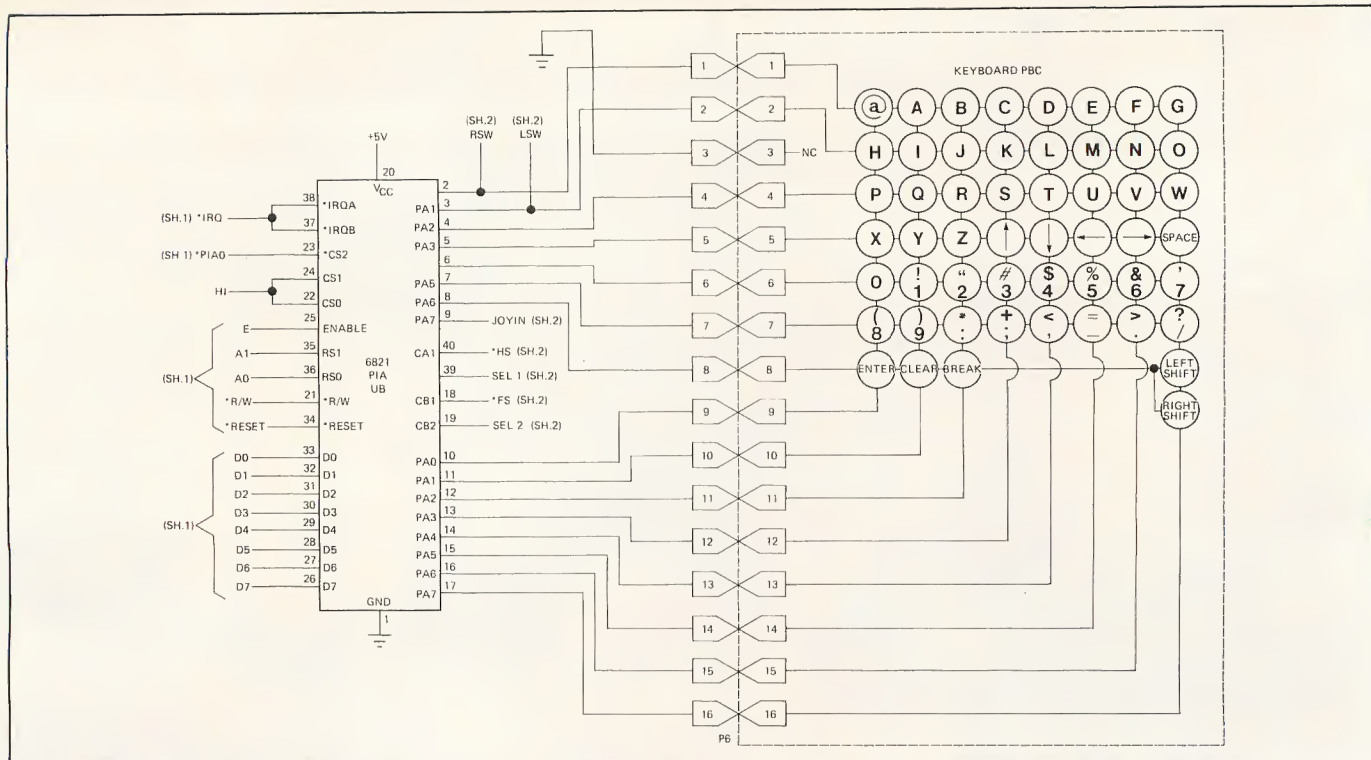


Figure 7. Color Computer keyboard matrix is connected to a PIA, which is scanned by the Basic software to identify keyswitch closings.

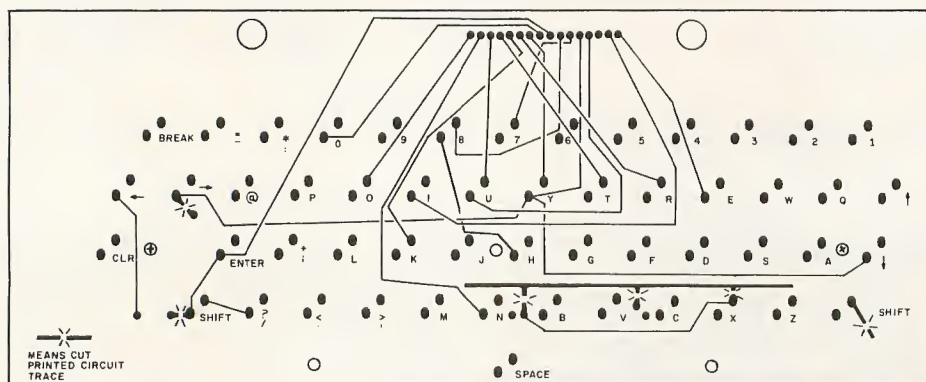


Figure 9. Trace cutting and wiring for Model I Keyboard conversion. Do not cut the wire jumpers already in place on the top side.

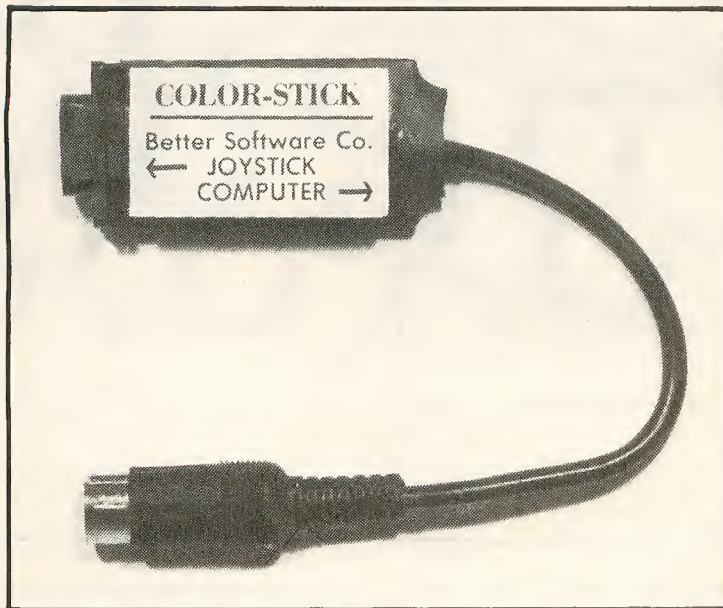
Table 1. Color Computer Revisions

Key to Figures:		Version	Comments
CLR = Clear	CLEAR	Color Basic 1.0	First released version
CPS = Caps lock	CAPS LOCK	Color Basic 1.1	Printer and joystick changes
CT = Carat	^	Color Basic 1.2	64K RAM memory-map SAM setup
CTL = Control	CONTROL	Extended Basic 1.0	First released version
DA = Down Arrow	↓	Extended Basic 1.1	New; details not known
DEL = Delete	DELETE	Disk Basic 1.0	First released version
ESC = Escape	ESCAPE	Disk Basic 1.1	New; details not known
LA = Left Arrow	←	Board revision C	First released version, 4/16K
LB = Left Bracket	[Board revision D	Revised memory selection
LF = Line Feed	LINE FEED	Board revision E	Internal 32K access added
RA = Right Arrow	→	Board revision NC	64K access, stabilized power
RB = Right Bracket]		
REP = Repeat	REPEAT		
SEP = Separator			
TL = Tilde	~		
UA = Up Arrow	↑		

Don't want to open your computer yet? NC revisions are identified by catalog numbers with "A" suffixes: 26-3002A, 26-3003A, 26-3004A.

BETTER SOFTWARE COMPANY Presents COLOR-STICK

The original interface that lets you use the Atari Joystick on your Color Computer.



70% of Actual Size

JOYSTK (0) & (1). The fire button is unchanged. In general, any normal joystick will work with the Color-Stick.

WHAT THE COLOR-STICK WILL WORK WITH:

Here is a list of joysticks and Color Computer games that will work with the Color-Stick interface. This list is by no means complete. This list is made up of joysticks and games that we have tried first hand and have worked with the Color-Stick.

JOYSTICKS: • Wico • Diskwasher • Atari • Commodore.

COLOR COMPUTER GAMES: • Football (RS) • Tennis (RS) • Berserk • Backgammon (RS) • Pac Attack (Slightly better) • Ghost Gobbler • Space War • Storm • Mega-Bug (RS) • Galax Attax • Offender • Poltergeist (levels one and two) • Microbes (Slightly better) • Pac-Droids • Color Scarfman • Astro-Blast • Ski (RS) • Project Nebula (Direction control) • Monkey Kong • Dunkey Munkey • Donkey King • Zaxxon • Monster Maze (CRS) • Star Raiders • Venture • Shooting Gallery • Doodle Bug • Robottack

New Lower Price!

Color-Stick Interface — \$10.95 each or
Two for \$19.95 (less joysticks)
Atari Joysticks — \$9.95

DESCRIPTION:

The Color-Stick is approximately 2½ inches long by 1¼ inches wide. It is encased in a heat formed plastic tubing. There is approximately 6 inches of cable and the computer's joystick plug attached to one end of the interface with the Atari plug on the other end. The inline design and soft plastic encasement makes it easy to attach and keeps it from interfering with the computer or joystick's operation.

OPERATION:

The Color-Stick interface merely changes the output of the Atari type joystick to a type of output the Color Computer can understand. Here is an example of the outputs.

Command	Up Left	Down Right	Neutral
JOYSTK (0)	0	63	Between 29 & 32
JOYSTK (1)	0	63	Between 29 & 32

The values for JOYSTK (2) & (3) are the same as any game that uses the four extreme directions of the

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Wiring the Keyboard

Once you have selected a keyboard, you will need to consider how to mount it, a carpentry process that I find harder than wiring. Unplug the computer, turn it over, remove the computer's screws, flip it on its feet, pull back the cover, and lift the keyboard up and toward you. Refer to the premiere issue of **The Color Computer Magazine** (March) for details and suggestions on opening your computer.

If you have an earlier computer, the keyboard connector will unplug from a row of posts; later machines have a flat contact cable that slides out of a clamp connector. In either case, hold the cable firmly, and pull it straight out.

Because of the additional depth of full-travel keyboards, the center support post must be removed from the computer's keyboard bay. Refer to last month's article for the hot razor blade technique of cutting a plastic post; this post isn't in a

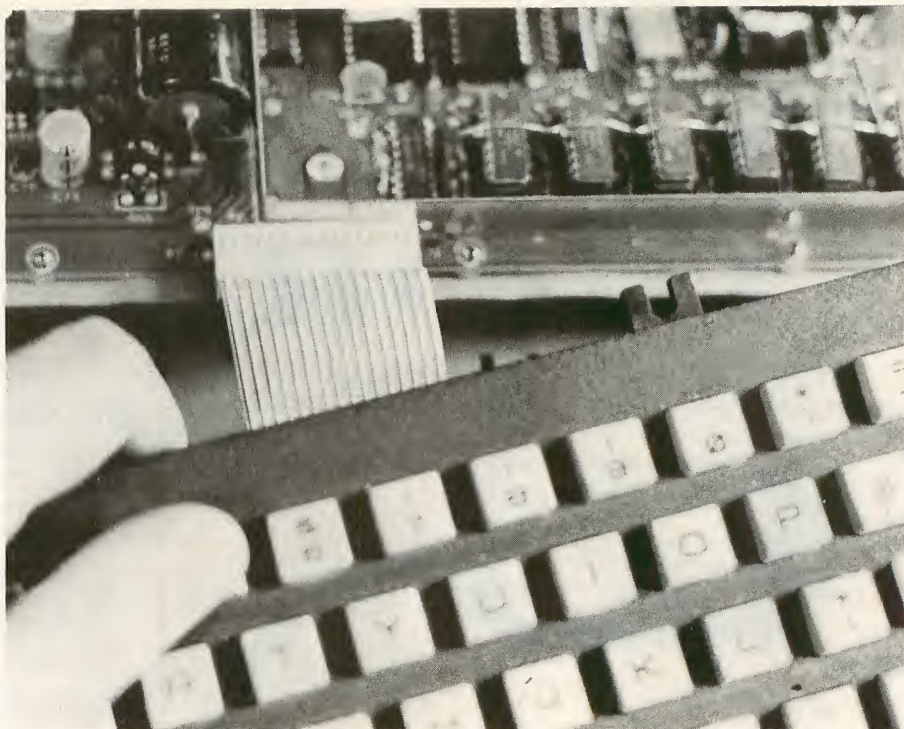


Photo 8. Remove Old Keyboard.

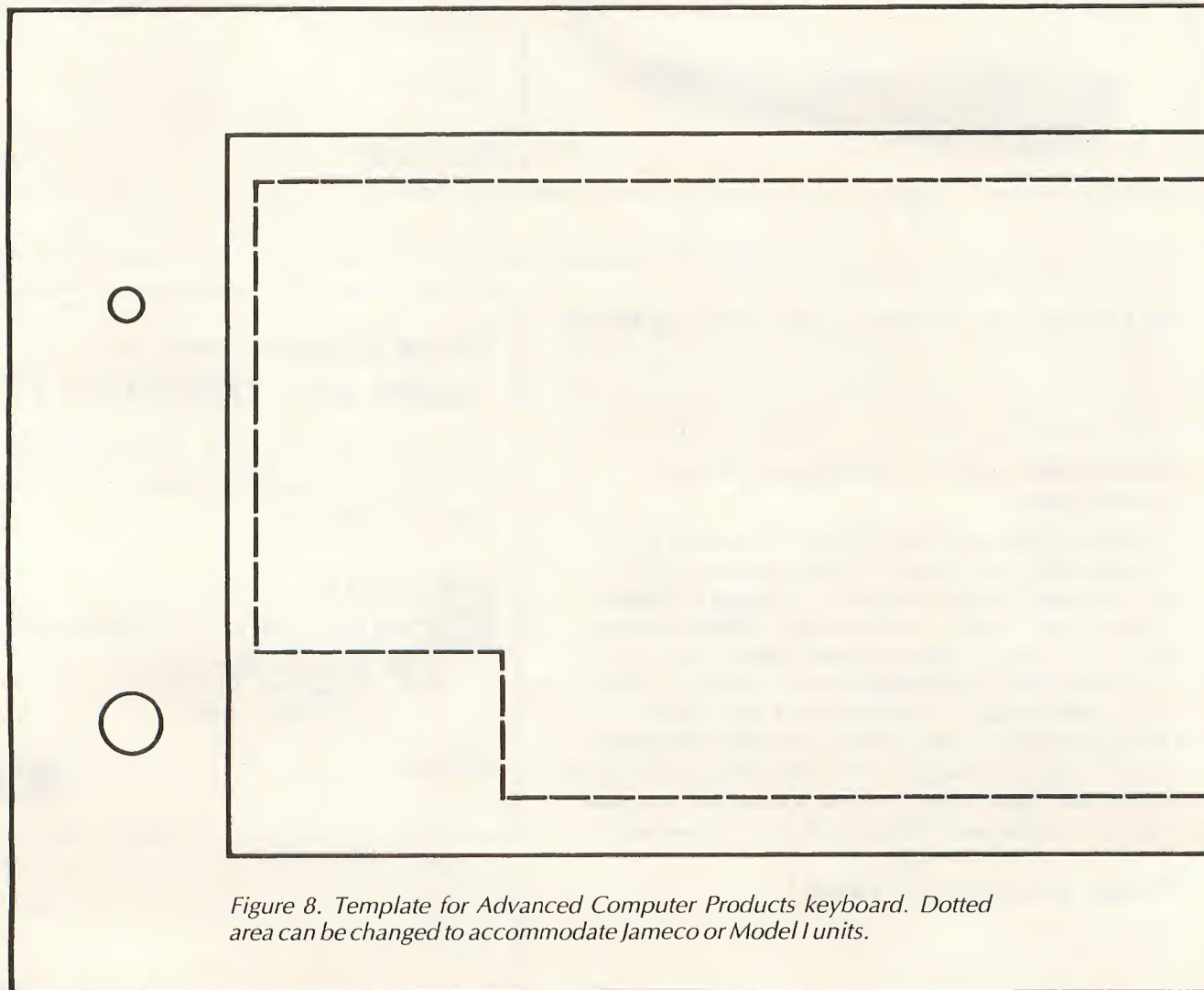


Figure 8. Template for Advanced Computer Products keyboard. Dotted area can be changed to accommodate Jameco or Model I units.

delicate area, so you can cut it out with a coping saw or clip it with small pruning shears.

Model I keyboards already have a base plate which can be cut and drilled to set comfortably on the existing support posts. For the Jameco and Advanced keyboards, however, you will need a firm template cut out of stiff cardboard, sheet plastic, or wall paneling. One-eighth-inch stock is adequate, but 1/4-inch material will give a better feel and closer mounting to the computer's top cover. A template for the Advanced keyboard is shown in Figure 8. Paint its top dark grey or black, remove the keytops from the perimeter keys, line the keybase perimeter with glue (silicone is soft, quiet, and shock-resistant), and press the template in place. When the glue sets and you are satisfied with the fit, replace the keys.

With the glue dry and the keytops back in place, you are ready to wire the keyboard. All keyboards are wired in the same pattern, although keys may show up in different physical positions. Since the Model I keyboard is already partly

connected on a printed circuit board, it needs some changes.

First, cut out or desolder the four integrated circuits at the bottom left, and clip out the resistors. Next, refer to Figure 9 for a trace cut and wiring jumper pattern. Lead all wires to some connection block on the back of the keyboard, in the order shown in the figure. (Model I keyboard users may skip down to the next subhead...)

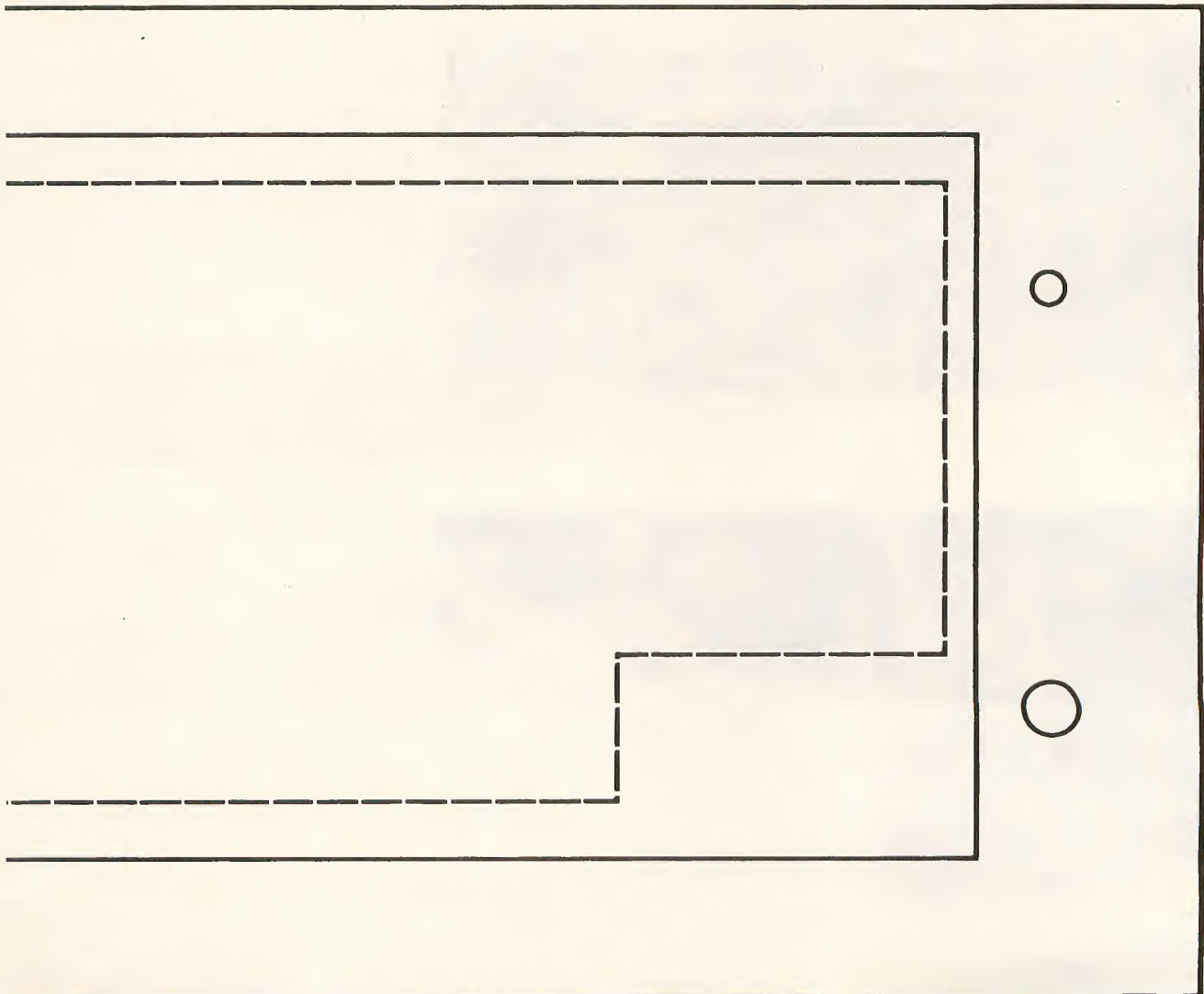
The Jameco and Advanced keyboards must be wired key by key since they are not mounted on boards. The key wiring suggestions I have made for the special keys (such as Control, Escape, Repeat, etc.) are arbitrary, so if you prefer another arrangement, use it. Just make sure you change *both* connections for that key — notice that there is a top right and bottom left connection point at the bottom of each key. Wire keys together as listed in Figure 10, and leave enough wire from each set of connections to lead two inches past the back of the keyboard. Number these wires as in the figure.

When soldering the keys, do it with a low-wattage iron and very fine solder. The key connections are *gold-plated*, so the solder will flow easily. If you heat the tabs too hot you can damage the key mechanism. Also, the tabs are very thin (actually made for circuit board mounting), and can break off. You can avoid this by using thin 28- or 30-gauge wire-wrap wire, and by not pulling on the connections as you lead the wire from key to key. (Please, please believe me. I have had far too many letters and phone calls from people who damaged something because they "didn't have" or "couldn't get" wire-wrap wire. Radio Shack has it. The catalog number is 278-501, -502, -503 or -504. Don't use any wire heavier than this!)

Connecting the Computer

With earlier machines, things are easier. You need only lead the wires to a 3M-type connector, available from Digi-

◆ next page



Key (#929974, \$1.49). This is a 34-pin female connector, and you only need 16 pins, so carefully snip or cut off the rest. Wire number 1 goes to the left as you face the computer, wire number 16 to the right. Notice that wire number 3 is not connected to the key matrix; it is a ground shield, and can be hooked to a metal plate underneath the keyboard for additional RF interference protection.

Newer computers with their nasty thin cable clamps are a problem. The order of connection is the same, but there is no easy way of imitating the flat cable connector. The simplest solution is to take each wire and solder it carefully to the back of the connector on the computer printed circuit board. There is plenty of mounting pin showing, and a thin soldering iron can get right in there. However, this makes the keyboard a permanent part of the computer.

A more attractive way is to obtain the female header (number 929974 from Digi-Key) and hook the wires from the

keyboard to it. Piggyback the male header on the computer's keyboard connector, pin for pin. Number 929835-03 will do the job; both of these connectors have to be shortened to 16 pins. The keyboard can now be removed easily and the original replaced, and if the computer ever needs service, Radio Shack techs won't likely object to the extra small connector.

Problems? Nothing serious can happen, but you might be missing a letter or having a few doubles here and there. Any difficulties will be simple key miswiring; when you start getting a nest of wires, it may be hard to follow which key is which. Remove the keyboard and test continuity with a meter; each row and column should form a complete, connected entity. When all connections are made and no rows or columns are shorted to others, you will enjoy a professional keyboard on your Color Computer.

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Photo 9. Cut The Post.

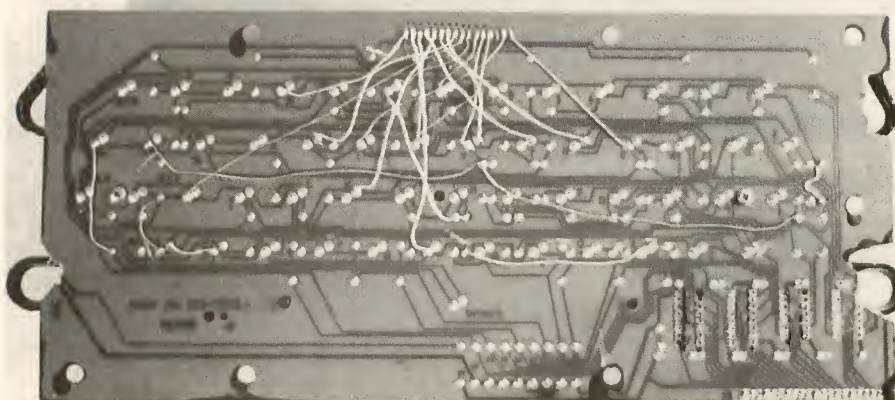


Photo 10. Wire New Keyboard.



Photo 11. Paint The New Base.



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Photo 12. Mount The Complete Unit.

Connection Point	Wire Together Jameco Keys	Wire Together Advanced Keys	Wire Number
TOP	(A A B C D E F G	(A A B C D E F G	#1
TOP	H I J K L M N O	H I J K L M N O	#2
TOP	P Q R S T U V W	P Q R S T U V W	#4
TOP	XYZ<ESC><CTL><TAB><SPC>	XYZ<ESC><CTL><RUB><LF><SPC>	#5
TOP	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	#6
TOP	<RET><REP><*><##><SHIFT>	<RET><CLR><SEP><##><SHIFT>	#8
BOT	(A H P X 0 8 <RET>	(A H P X 0 8 <RET>	#9
BOT	A I Q Y 1 9 <REP>	A I Q Y 1 9 <CLR>	#10
BOT	B J R Z 2 : <*>	B J R Z 2 : <SEP>	#11
BOT	C K S <ESC> 3 ; <##>	C K S <ESC> 3 ; <##>	#12
BOT	D L T <CTL> 4 , <##>	D L T <CTL> 4 , <##>	#13
BOT	E M U 5 = <##>	E M U = <gg>	#10
BOT	F N V <TAB> 6 . <##>	F N V <LF> '6 . <##>	#15
BOT	G O W <SPC> 7 ? <SHIFT>	G O W <SPC> 7 ? <SHIFT>	#16

Use <SEP> for Break on Advanced keyboard.
 Use <REP> for Clear on Jameco keyboard.
 <*> = Select any unused key for Break on Jameco keyboard.
 <##> = Select any unused four keys for these spots.

Parts Availability

Keyboard modification:

Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002, (415) 592-8097. Keyboard #K62, \$34.95.

Advanced Computer Products, P.O. Box 17329, Irvine CA 92713-7329, (800) 854-8230. "58 Key Keyboard," \$19.95.

Digi-Key Corporation, Hiway 32 South, P.O. Box 677, Thief River Falls MN 56701, (800) 346-5144. Female header number 929974, \$1.49; male header number 929835-03, \$2.09.

Radio Shack: Wire-wrap wire number 278-501 through 278-504, \$2.39. Deleted keyboard number 1700070, about \$20 when available.

Updates

I tripped over my truth tables in the May CoCoPort article. The circuit as drawn addresses the ports from \$FF50 to \$FF53. ■ ■ ■

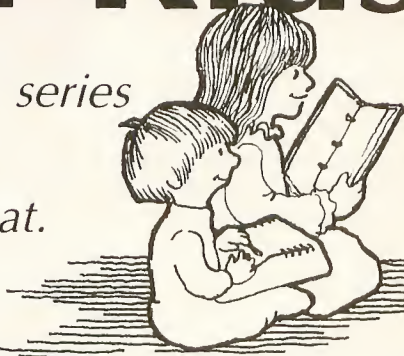
Figure 10. Key wiring patterns for Jameco & Advanced Keyboards. Special keys are arbitrary, and remaining keys can be wired into unused points in the Color Computer matrix (see Figure 7).



Photo 13. Done!

Color Computing for Kids

*The second in a series
for Kids, with a
Hallowe'en treat.*



AS THE DAYS OF OCTOBER pass many of you will be secretly planning costumes and special effects to surprise all the other trick-or-treaters on Hallowe'en. Then you'll put together all the special materials that will create just what you had in mind when — POOF! — it's suddenly Hallowe'en and your secret plans and work pay off in excitement and fun for everyone. But if you're like me, as the candles burn down in the Jack o'Lanterns and the trick-or-treaters head for home, your mind is already planning for next Hallowe'en — thinking of changes and new ideas to make it even better than this year's.

Computer programming is much the same. You get an idea, plan how you want it to look on your computer's television screen (CRT), organize and put together the BASIC statements that are like a secret code which becomes a computer program you enter on your computer's keyboard. Then when you type RUN — POOF! — the fun and excitement begins

by Jean Plessner

for everyone as your planning and work come to life on your CRT. But, watch out! The "computer bug" is easy to catch! Computer programming is fun and rewarding and you may find that as soon as a program is finished you're already thinking of changes to make it better, or planning a totally new program.

Maybe the "bug" will get you this month as you learn some programming using screen colors and how to print at any location on the screen. You'll find a game program using screen colors, and two programs especially for Hallowe'en. Have fun experimenting and getting to know your computer better.

Screen Colors

In Color Basic, each color is represented by a number. They are:

- 0 — BLACK
- 1 — GREEN
- 2 — YELLOW
- 3 — BLUE
- 4 — RED
- 5 — BUFF
- 6 — CYAN
- 7 — MAGENTA
- 8 — ORANGE

Let's try them on your screen so you can see what each looks like. Turn your computer and CRT on. If you want to start typing on a blank screen just press the CLEAR key — it erases the screen so you can concentrate better! Now type this BASIC statement:

CLS(0)

Remember to always press the ENTER key after you finish an entry. This puts the statement in the computer's memory if there's a line number or, in this case, puts the statement to work right away.

♦ next page



Photo 1a. This is how the computer screen looks when you type CLS(4).



Photo 1b. This is how the computer screen looks when you type CLS(3).



Photo 1c. This is how the computer screen looks when you type CLS(7).



Photo 2. This is CLS(4) and a GOTO statement.

The number of the color you want to use always goes inside the parentheses (). CLS(0) will clear your screen with the color black, but there will be a green line at the top of the screen with the word prompt "OK" printed above the blinking cursor. Your computer prints words (text), symbols, and blank spaces on a green background. It also fills in the end of each line with blank spaces, so that's why the entire line, after the prompt "OK," is green.

The cursor is waiting for you to type something else, so keep entering the CLS() statement, trying a different number inside the parentheses each time, until you've seen all the colors on your screen. You'll finally be able to see what colors buff, cyan, and magenta really are!

The GOTO Statement

Now let's use the CLS() statement in a program along with a GOTO statement so we can get rid of the green line and the cursor. Before you enter a new program always type NEW to erase the computer's memory, press ENTER, then type:

```
10 CLS(0)
20 GOTO 20
```

When you're ready to see the program work, type RUN. The computer reads Line 10 first and clears the screen to black. Then Line 20 is read and the computer keeps reading it over and over again because GOTO 20 means read that line again and do what it says. This puts the computer in a loop and keeps the program from ending and printing that green line again.

Since we put the computer in a loop without an end, there's only one way to stop it, and that's with the BREAK key. When you press the BREAK key during a running program the computer will tell you what line it stopped at — in this case it will say: BREAK IN 20, because it stopped at Line 20.

The LIST Command

Now type LIST and press ENTER. The computer just printed (listed) your program on the screen, and it will do this whenever you have a program in memory and you use the LIST command. There will be times when your program is too long for all of it to appear on the screen at one time. When this happens you can press the BREAK key to stop the listing at any place you want. A much better way is to type the LIST command, followed by only the line numbers you wish to see. LIST 10-50 would list all the lines from 10 to 50. LIST 10 would list only Line 10. You will be able to practice this later when you have a longer program in memory.

Changing a Program Line

Let's change Line 20. You do this by typing the line number again, then the new statement. When you press ENTER the new line will replace the old one in the computer's memory. Type:

```
20 GOTO 10
```

Now type RUN. Anything new? No, because we're still in a loop that keeps the program from ending. This loop goes back to Line 10 and clears the screen with black over and over again. Remember how to stop the program? Right, press the BREAK key.

Erasing a Program Line

Let's erase Line 20 so you can see what would happen without a GOTO statement in the program. To erase, or delete, a line from the computer's memory, type only the line number, then Press ENTER — in this case type the number 20. Now type LIST and 10 CLS(0) will appear on the screen. Type RUN — the green line comes back and you don't have to press the BREAK key to end the program. The program stopped as soon as it ran out of lines to read.

A Colors Game

Since the cursor is once again waiting for you to type something new, let's do something in one program with all those screen colors. Type NEW then enter this program:

```
10 REM GUESS MY COLOR GAME
20 CLS(0): CLS(1): CLS(2)
30 CLS(3): CLS(4): CLS(5)
```

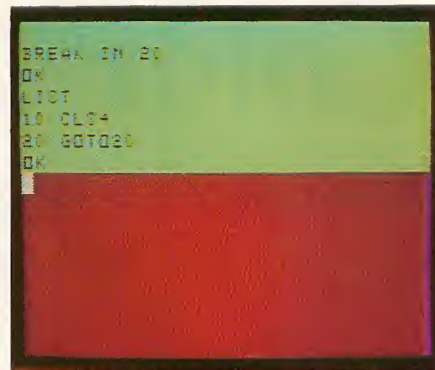


Photo 3. A LISTed program.

```
40 CLS(6): CLS(7): CLS(8)
50 GOTO 20
```

Did you remember to press the ENTER key at the end of each line? Line 10 is a remark (REM) statement. The computer ignores REM statements, so you can put them anywhere you want in a program. Use them for notes about the program or, like this one, to give it a name. The colons (:) are used between statements that are put on one line. In this case, if I didn't use them each CLS() statement would have to have its own line number, which would make the program much longer. Short statements like these can be combined in one line. Line 50 sends the computer back to Line 20 so that Lines 20, 30, and 40 are read over and over again — at least until you press the BREAK key.

Before you type RUN, here's how to play the game — get someone to play with you, then take turns at the keyboard. The player types RUN, then calls out a color and presses the BREAK key. If the screen shows the color the player called out, then he or she gets a point. The next player then types RUN and calls out a color. Set a limit on the number of plays or time, and the player with the most points when the limit is up is the winner.

Saving Your Programs

Entering programs can take a lot of time, and once a program is running without errors no one wants to type it again and again. You have either a cassette recorder or a disk drive with which to save your programs. Because saving and loading programs must be done properly and carefully, and requires a series of exact steps, I won't try to direct you in this article. Ask the computer expert in your home to help you learn to save and load your programs. This is also a good time for you to get your own cassette tape or disk for all your future programs.

♦ to page 53

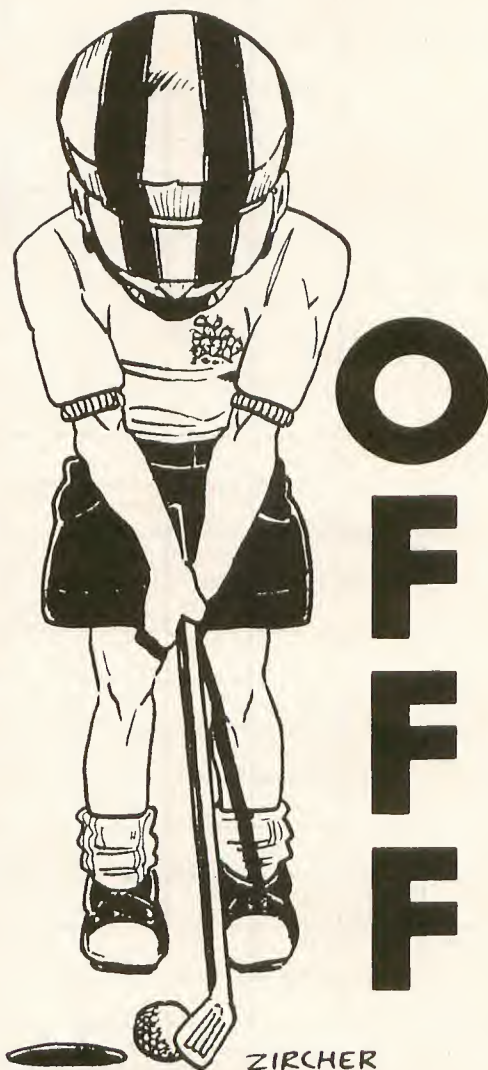


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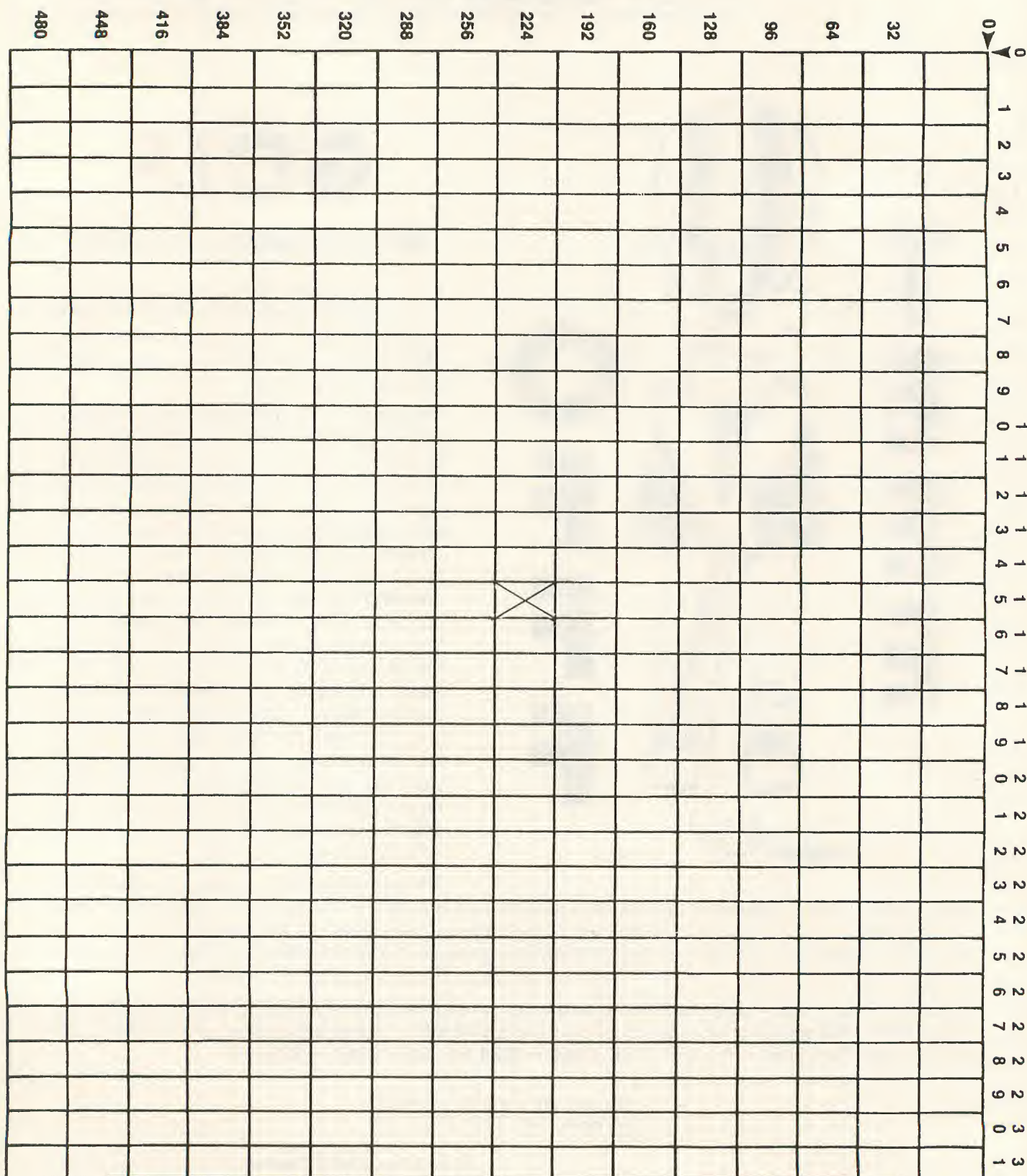


Figure 1. A screen map.



The PRINT @ Statement and the Screen Map

Last month we used the PRINT statement in many different ways, and also learned that we can use the question mark(?) in place of the word "PRINT" to save time. You've also learned that the computer always starts printing at the top left corner of the screen, but you can tell it to print at other locations on the screen by using the "PRINT @" (the @ symbol means at) statement. Before we can use the PRINT @ statement we need to look at a screen map — and there just happens to be one here labelled Figure 1. Look at it as you read the following.

A screen map shows all the spaces on your CRT that you can print on. The screen has sixteen (16) lines with thirty-two (32) spaces on each line. Each space has a number, like a street address, that is already in the computer's memory. The first space (in the upper left corner) is 0, the next space over is 1, then 2, and each space is one more until the last space (in the lower right corner), which is number 511.

Finding these spaces is much easier than counting. At the top of the screen map are the numbers 0 to 31 and along the left side are the numbers 0 to 480. To find a certain space number you first go to the line you want to print on, then move your finger along that line until you get to the space where you want to start printing. Now look at the number on the top line that is right in a line above your finger — add this number to the number on the left at the beginning of the line where your finger is, and the total is your PRINT @ location. *Don't panic* — it's not as hard as it may sound.

Let's find a space number together. I've placed an "X" on a space in the center of the screen map — that space is on the line that's numbered 224 and it's right under the number 15: got it? $224 + 15 = 239$, so, 239 is the PRINT @ location. If you were going to print something at this location, your statement would say: PRINT @ 239, "XXXX" (this is just an example, we'll use real statements later.)

♦ to page 55

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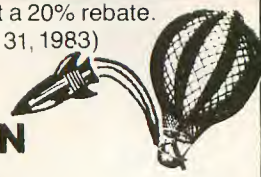
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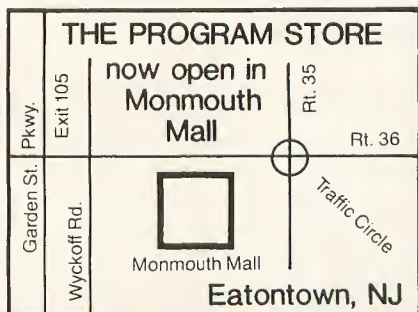
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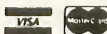
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The Computer as a Calculator

To make it even easier, your computer will do the adding for you. Once you have found the space, you would type: PRINT 224 + 15. When you press ENTER, the computer prints 239 on the next line. Practice this by finding the location number of other points (spaces) on the screen map, then use the computer to add the numbers for you.



Photo 4. The Computer as a Calculator.

Centering

Now let's work this information into a program to print "HAPPY HALLOWEEN" on the center of the screen. Start at the "X" on the screen map and count backward one space for every two letters. This puts us at: $224 + 9 = 233$. Here's the program:

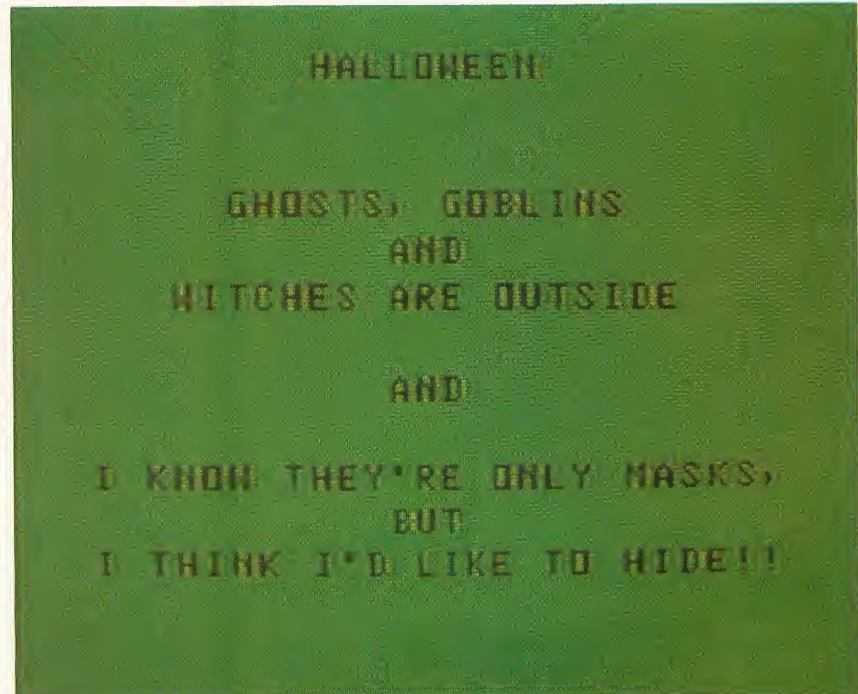
```
10 CLS
20 PRINT @ 233, "HAPPY
  HALLOWEEN"
30 GOTO 30
```

Always use a comma (,) after a space number and you can use the question mark (?) in place of the word "PRINT," also. Type RUN to see how it looks, and don't forget to use the BREAK key to stop the loop. For practice, change the PRINT @ location number in Line 20 a few times.

One last note about screen mapping. Graph paper does *not* work well for planning a CRT display — especially for pictures. Graph paper is lined with *squares* and the spaces on your screen are made up of *tall rectangles*. If you use graph paper, the picture will turn out to be taller and thinner than you planned. Get copies of a PRINT @ Screen Map for your own use.

Now the Fun Stuff

The lesson is over! I've written two programs that use all you've learned. The



first prints a Hallowe'en poem, and should give you some ideas for mapping out poems of your own. The second program is a Hallowe'en greeting with a picture of a Jack o'Lantern. This program can be used on Hallowe'en — just place your CRT in a window, or entry way, and RUN the program to greet all your trick-or-treaters. Ask an adult to help you set it up.

The Jack o'Lantern program is done with lots of spaces between the quotation marks (" "). To make it easier for you to count the spaces, I've written in the listing the number of times you'll need to press the spacebar, inside the quotation

marks (" "). Don't type these numbers — just use them for counting spaces, but be sure to type everything else exactly as you see it. A semicolon (;) at the end of a PRINT statement tells the computer to keep printing on the same line, and the word "PRINT" used alone on a line tells the computer to print a blank line.

Next month we'll "hear" from our computer with the SOUND command, plus learn to use a loop that repeats only the number of times we tell it to — goodbye BREAK key!

Have a fun and safe Hallowe'en!! See you next month!

■ ■ ■

Program ♦

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Program Listing 1. Hallowe'en Poem

```

10 REM- A HALLOWEEN POEM
20 CLS : PRINT
30 PRINT @ 43, "HALLOWEEN"
40 PRINT : PRINT
50 PRINT @ 136, "GHOSTS, GOBLINS"
"
60 PRINT @ 174, "AND"
70 PRINT @ 198, "WITCHES ARE OUT"
SIDE"
80 PRINT : PRINT @ 270, "AND" :
PRINT
90 PRINT @ 323, "I KNOW THEY'RE"
ONLY MASKS,"
100 PRINT @ 366, "BUT"
110 PRINT @ 387, "I THINK I'D LI"
KE TO HIDE!!"
120 GOTO 120

```

Program Listing 2. Jack o'Lantern

```

10 REM- JACK O' LANTERN GREETING
20 CLS(8) : PRINT
30 PRINT "_____14_____"; : PRI
NT @ 50, "-1-"
40 PRINT "_____12_____"; : PRINT
@ 84, "-2-"
50 PRINT "_____10_____"; : PRINT @
109, "-1-";
55 PRINT @ 114, "-1-"; : PRINT @ 1
18, "-1-"
60 PRINT "_____9_____"; : PRINT @
140, "-3-";
65 PRINT @ 145, "-3-"; : PRINT @
151, "-1-"
70 PRINT "_____8_____"; : PRINT @ 1
84, "-1-"
80 PRINT "_____8_____"; : PRINT @ 2
07, "-2-";
85 PRINT @ 216, "-1-"
90 PRINT "_____8_____"; : PRINT @ 2
48, "-1-"
100 PRINT "_____9_____"; : PRINT @
268, "-2-";
105 PRINT @ 274, "-2-"; : PRINT @
279, "-1-"
110 PRINT "_____10_____"; : PRINT
@ 301, "_____6_____";
115 PRINT @ 310, "-1-"
120 PRINT "_____12_____"; : PRIN
T @ 340, "-2-"
130 PRINT "_____20_____
: PRINT
140 PRINT "_____8_____HAPPY-2-HALLOW
EEN"
150 GOTO 150

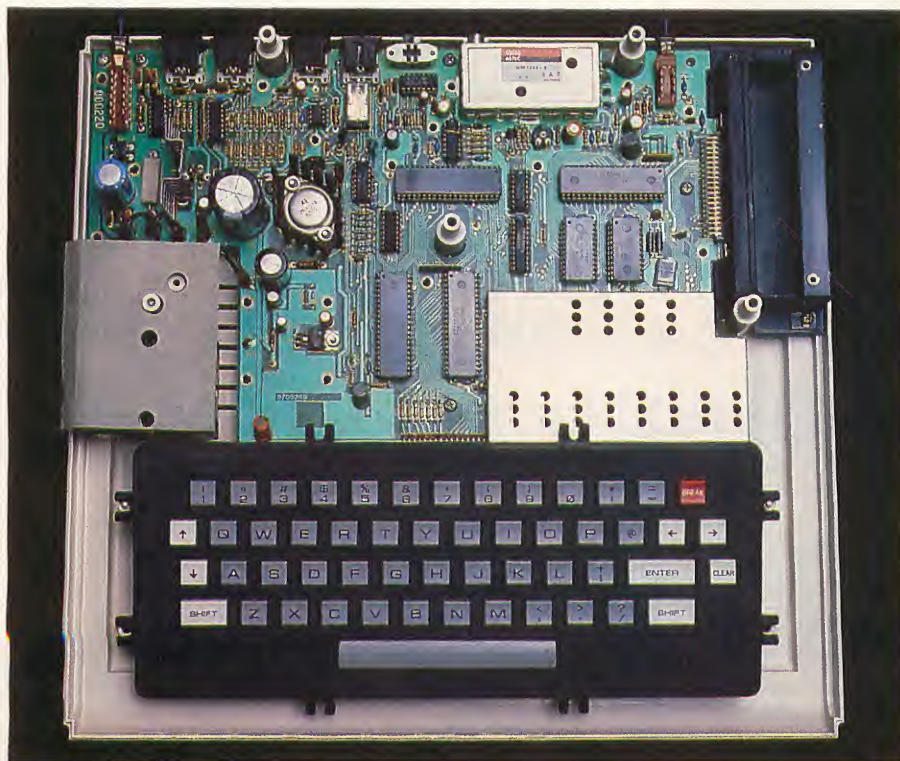
```


Dissecting Your ROM

*Part four of
a twelve-part series.*

by Jake Commander

photo by Charley Freiberg



AS PROMISED, this month sees the disassembly firmly on the tracks, with pure machine code to look at. Last month the disassembly went crunching through a couple of tables (including the Basic vocabulary and error codes), which wasn't too much fun. Now we start on the code which makes the Basic interpreter tick.

Included in this portion of ROM are the routines which go into direct mode, with or without an error-message to get you there. If you pick your way through the code (you may need a machete), you can see where the interpreter decides either to store a Basic line or execute it directly. Alongside this code is the routine that opens up a gap for new lines in your program. Notice that many routines of this type make a check (via another routine) to see if enough memory exists to accomplish the task at hand. If not, you'll see the all too familiar OM ERROR message.

After the more mundane housekeeping chores (tidying line pointers and the like), the real business starts. Starting with the For statement, we get to see the code which deals with other important Basic commands. Many of these statements are allied in some way, and can be dealt with by nearly the same code. As an example, there's very little difference between End or Stop. Read and Input are also very similar. Notice how REM, Data and If statements are grouped together into a routine whose main function is to step, character by character, to the next Basic statement.

It's pretty fascinating to watch the intricate workings of the interpreter. There are so many pieces to the whole that it sometimes defeats human comprehension. How this thing can work so flawlessly is a testimony to MicroSoft. ■ ■ ■

Program ▸

Program Listing. ROM Dissection

```

Pointer routine used by FOR
----- ABP9 30 64 LEAX +$04,S
----- ABP8 C6 12 LDB #S12
01568 ABFD 9F 0F STX <$0F
01569 ABFF A6 84 LDA ,X
01570 AC01 80 80 SUBA #S80
01571 AC03 26 15 BNE $AC1A
01572 AC05 AE 01 LDX 1,X
01573 AC07 9F 11 STX <$11
01574 AC09 9E 3B LDX <$3B
01575 AC0B 27 09 BEQ $AC16
01576 AC0D 9C 11 CMPX <$11
01577 AC0F 27 09 BEQ $AC1A
01578 AC11 9E 0F LDX <$0F
01579 AC13 3A ABX $ABFB
01580 AC14 20 E5 BRA $AC1E
01581 AC16 9E 11 LDX <$11
01582 AC18 9F 3B STX <$3B
01583 AC1A 9E 0F LDX <$0F
01584 AC1C 4D TSTA
01585 AC1D 39 RTS

Open gap for new line.
01586 AC1E 8D 17 BSR $AC37
01587 AC20 DE 41 LDU <$41
01588 AC22 33 41 LEAU 1,U
01589 AC24 9E 43 LDX <$43
01590 AC26 30 01 LEAX 1,X
01591 AC28 A6 82 LDA ,X
01592 AC2A 36 02 PSHU A
01593 AC2C 9C 47 CMPX <$47
01594 AC2E 26 F8 BNE $AC28
01595 AC30 DF 45 STU <$45
01596 AC32 39 RTS

Check MEM
01597 AC33 4F CLRA
01598 AC34 58 ASLB
01599 AC35 D3 1F ADDD
01600 AC37 C3 003A ADDD #S003A
01601 AC3A 25 08 BLO $AC44
01602 AC3C 10DF 17 STS <$17
01603 AC3F 1093 17 CMPD $AC3F
01604 AC42 25 EE BLO $AC32
01605 AC44 C6 0C LDB #S0C

Error processing.
01606 AC46 BD 018E JSR $018E
;Get char. from after old line
;into new position
;All done?
;Continue if not
;=> encoded buffer
;=> encoded buffer
;=> If no characters
;Old BASIC next pointer
;Save it
;Allow for buffer length
;Save poss. next addr. for BASIC
;=> Open gap for new line
;=> Line # + encoded line
;Get new line character
;To BASIC
;Done all?
;Continue till done
;Possible next BASIC addr. is....
;Next address for BASIC
;=> Reset variable pointers
;=> Reset BASIC Line pointers
;Direct mode

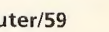
PULU A
STA ,X+
CMPX <$1B
BNE $ACCO
LDA $02DC
BEQ $ACE9
LDD <$1B
STD <$43
ADDB <3
ADCA #0
STD <$41
JSR $AC1E
LDU #S02D8
PULU A
STA ,X+
CMPX <$45
BNE $ACDD
LDX <$41
STX <$1B
BSR $AD21
BSR $ACEF
BRA $AC7C

Reset BASIC link pointers.
01678 ACEF 9E 19 LDX <$19
01679 ACF1 EC 84 LDD ,X
01680 ACF3 27 21 BEQ $AD16
01681 ACF5 33 04 LEAU 4,X
01682 ACF7 A6 C0 LDA ,U+
01683 ACF9 26 FC BNE $ACF7
01684 ACFB EF 84 STU ,X
01685 ACFD AE 84 LDX ,X
01686 ACFE 20 F0 BRA $ACF1

Search for line number in (2B), Set carry flag if no go.
01687 AD01 DC 2B LDD <$2B
01688 AD03 9E 19 LDX <$19
01689 AD05 EE 84 LDU ,X
01690 AD07 27 09 BEQ $AD12
01691 AD09 10A3 02 CMPD 2,X
01692 AD0C 23 06 BLS $AD14
01693 AD0E AE 84 LDX ,X
01694 AD10 20 F3 BRA $AD05
01695 AD12 1A 01 ORCC #1
01696 AD14 9F 47 STX <$47
01697 AD16 39 RTS

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01748	AD8B 9D 9F	JSR	<\$9F	;-> Parse next character	01843	AE5A 1F 10	TFR	X,D	;hi mem to D
01749	AD8D BD B141	JSR	\$B141	;-> Compute # variable	01844	AE5C A3 E1	SUBD	,S++	;Clearing more than available?
01750	AD90 BD BC6D	JSR	\$BC6D	;-> Get sign	01845	AE5E 25 12	BLO	\$AE72	;-> ?OM ERROR if so
01751	AD93 BD B1E6	JSR	\$B1E6	;-> FPAC1 to stack + sign	01846	AE60 1F 03	TFR	D,U	;Possible new stack top
01752	AD96 DC 3B	LDD	<\$3B	;Varptr	01847	AE62 83 003A	SUBD	\$003A	;Room for working stack:58 bytes?
01753	AD98 34 06	PSHS	A,B	;"FOR" marker	01848	AE65 25 0B	BLO	\$AE72	;
01754	AD9A 86 80	LDA	#\$80		01849	AE67 93 1B	BLO	<\$1B	;
01755	AD9C 34 02	PSHS	A		01850	AE69 25 07	BLO	\$AE72	;
Between statements.									
01756	AD9E BD 019A	JSR	\$019A	;->RAM (won't RTS in Ext. Basic)	01851	AE6B DF 21	STU	<\$21	;New stack top
01757	ADAL 1C AF	ANDCC	#\$AF	;Enable Interrupts	01852	AE6D 9F 27	STX	<\$27	;New hi mem
01758	ADA3 8D 46	BSR	\$ADEB	;-> Scan for Pause/BREAK	01853	AE6F 7E AD26	JMP	\$AD26	;-> CLEAR
01759	ADA5 9E A6	LDX	<\$A6	;Save pointer to...	01854	AE72 7E AC44	JMP	\$AC44	;-> " ?OM ERROR".
01760	ADA7 9F 2F	STX	<\$2F	;...statement start	RUN				
01761	ADA9 A6 80	LDA	X+	;Get next BASIC character	01855	AE75 BD 0194	JSR	\$0194	;-> RAM
01762	ADAB 27 07	BEQ	\$ADB4	;If end of line	01856	AE78 BD A426	JSR	\$A426	;-> Close files
01763	ADAD 81 3A	CMPA	#\$3A	;Is this a new statement?	01857	AE7B 9D A5	JSR	<\$A5	;
01764	ADAF 27 0F	BEQ	\$ADC0	;Yes, interpret	01858	AE7D 1027 FEAO	LBEQ	\$AD21	;-> Parse current character
01765	ADB1 7E B277	JMP	\$B277	;-> ?SN ERROR	01859	AE81 BD AD26	JSR	\$AD26	;-> If "RUN <ENTER>"
01766	ADB4 A6 81	LDA	X++	;Get next pointer	01860	AE84 20 19	BRA	\$AE9F	;-> Do CLEAR
01767	ADB6 97 00	STA	<0	;Flag "END" just in case	GO /TO				
01768	ADB8 27 5B	BEQ	\$AE15	;-> If end of text	01861	AE86 1F 89	TFR	A,B	;
01769	ADBA EC 80	LDD	X+	;Current line number	01862	AE88 9D 9F	JSR	<\$9F	;
01770	ADBC DD 68	STD	<\$68	;"Parse" pointer	01863	AE8A C1 A5	CMPB	#\$A5	;
01771	ADBE 9F A6	STX	<\$A6		01864	AE8C 27 16	BEQ	\$AEA4	;-> Yes
Interpret.									
01772	ADC0 9D 9F	JSR	<\$9F	;	01865	AE8E C1 A6	CMPB	#\$A6	;
01773	ADC2 8D 02	BSR	\$ADC6	;-> Leave return on stack	01866	AE90 26 45	BNE	\$AED7	;-> SN ERROR if not
01774	ADC4 20 D8	BRA	\$AD9E	;-> Between statements <-	01867	AE92 C6 03	LDB	#3	;
01775	ADC6 27 78	BEQ	\$AE40	;-> If End Of Line, RTS	01868	AE94 BD AC33	JSR	\$AC33	;
01776	ADC8 4D	TSTA		;-> If not a token	01869	AE97 DE A6	LDD	<\$A6	;
01777	ADC9 102A 01BC	LBPL	\$AF89	;Is it greater than SKIPF?	01870	AE99 9E 68	LDX	<\$68	;
01778	ADCD 81 A3	CMPA	#\$A3	;-> If so	01871	AE9B 86 A6	LDA	#\$A6	;
01779	ADCF 22 0B	BHI	\$ADDC	;-> If so	01872	AE9D 34 52	PSHS	A,X,U	;
01780	ADD1 BE 0123	LDX	\$0123	;-> Command Jump Table	01873	AE9F 8D 03	BSR	\$AEA4	;
01781	ADD4 48	ASLA		;-> times 2	01874	AEA1 7E AD9E	JMP	\$AD9E	;
01782	ADD5 1F 89	TFR	A,B	;-> Offset to X	Goto line statements				
01783	ADD7 3A	ABX		;					
01784	ADD8 9D 9F	JSR	<\$9F	;					
01785	ADDA 6E 94	JMP	(,X)	;-> Do it					
Parse current char.									
01786	ADDC 81 B4	CMPA	#\$B4	;-> Is the token > \$B4?					
01787	ADDE 23 D1	BLS	\$ADB1	;-> If not					
01788	ADDE 6E 9F 012D	JMP	(012D)	;-> If token > \$B4					
RESTORE									
01789	ADE4 9E 19	LDX	<\$19	;BASIC start					
01790	ADE6 30 1F	LEAX	-1,X	;Subtract 1					
01791	ADE8 9F 33	STX	<\$33	;Data pointer					
01792	ADEA 39	RTS							
Scan for break or shift "e"									
01793	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01794	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01795	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01796	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01797	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01798	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01799	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01800	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01801	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01802	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01803	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01804	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01805	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01806	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01807	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01808	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01809	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01810	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01811	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01812	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01813	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01814	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01815	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01816	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01817	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01818	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01819	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01820	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01821	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01822	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01823	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01824	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01825	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01826	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01827	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01828	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01829	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01830	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01831	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01832	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01833	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01834	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01835	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01836	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01837	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01838	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01839	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01840	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01841	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01842	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01843	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01844	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01845	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01846	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01847	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01848	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01849	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01850	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01851	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01852	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01853	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01854	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01855	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01856	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01857	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01858	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01859	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01860	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01861	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01862	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01863	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01864	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01865	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01866	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01867	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01868	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01869	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01870	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01871	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01872	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01873	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01874	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01875	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01876	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01877	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01878	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01879	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01880	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01881	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01882	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01883	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01884	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01885	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01886	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01887	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01888	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01889	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01890	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01891	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01892	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01893	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01894	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01895	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01896	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01897	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
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01898	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01899	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01900	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01901	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01902	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char.									
01903	ADEB BD A1C1	JSR	\$A1C1	;-> Scan keyboard					
Parse current char									


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01794 ADDE 27 0A BEQ $ADFA
01795 ADF0 81 03 CMPA #3
01796 ADF2 27 15 BEQ $AE09
01797 ADF4 81 13 CMPA #313
01798 ADF6 27 03 BEQ $ADFB
01799 ADF8 97 87 STA <$87
01800 ADFA 39 RTS
01801 ADPB BD ALCL JSR $A1C1
01802 ADPB 27 FB BEQ $ADFB
01803 AE00 20 EE BRA $ADFO
END
01804 AE02 BD A426 JSR $A426
01805 AE05 9D A5 JSR <$A5
01806 AE07 20 02 BRA $AE0B

STOP
01807 AE09 1A 01 ORCC #1
01808 AE0B 26 33 BNE $AE40
01809 AE0D 9E A6 LDX <$A6
01810 AE0F 9F 2F STX <$2F
01811 AE11 06 00 ROR <0
01812 AE13 32 62 LEAS 2,S
01813 AE15 9E 68 LDX <$68
01814 AE17 8C FFFF CMPX #FFFFFF
01815 AE1A 27 06 BEQ $AE22
01816 AE1C 9F 29 STX <$29
01817 AE1E 9E 2F LDX <$2F
01818 AE20 9F 2D STX <$2D
01819 AE22 0F 6F CLR <$6F
01820 AE24 8E ABF1 LDX #ABF1
01821 AE27 0D 00 TST <0
01822 AE29 102A F546 LBPL $AC73
01823 AE2D 7E AC68 JMP $AC68

CONT
01824 AE30 26 0E BNE $AE40
01825 AE32 C6 20 LDB #20
01826 AE34 9E 2D LDX <$2D
01827 AE36 1027 FE0C LBEQ $AC46
01828 AE3A 9F A6 STX <$A6
01829 AE3C 9E 29 LDX <$29
01830 AE3E 9F 68 STX <$68
01831 AE40 39 RTS

CLEAR
01832 AE41 27 2C BEQ $AE6F
01833 AE43 BD B3E6 JSR $B3E6
01834 AE46 34 06 PSHS A,B
01835 AE48 9E 27 LDX <$27
01836 AE4A 9D A5 JSR <$A5
01837 AE4C 27 0C BEQ $AE5A
01838 AE4E BD B26D JSR $B26D
01839 AE51 BD B73D JSR $B73D
01840 AE54 30 1F LEAX <-1,X
01841 AE56 9C 74 CMPX <$74
01842 AE58 22 18 BHI $AE72

;If no input
;Is it a break?
;-> If yes, STOP
;Is it a shift 0?
;-> If so
;Else store as INKEY$
;Wait for keyboard input (pause)
;Nothing yet
;Check character again
;Close files
;Parse current
;Set carry to flag STOP
;If not end of line
;Current BASIC pointer
;= current statement pointer
;Possible carry to <0
;Ignore RTS address
;Current line #
;In Direct mode?
;Yes, no line #
;Save CONT line number
;Get current pointer
;Save as CONT pointer
;Set video output
;=> "BREAK"
;END or STOP?
;-> Do "OK" if END
;-> Print "BREAK" etc if STOP

;If not end of statement
;Possible error code
;CONT pointer
;-> Can't CONT
;Save current pointer
;CONT line number
;Current line number

;-> If not CLEAR n
;-> Compute mnr less than 65536
;Save number
;Current hi mem
;-> Parse current character
;-> If no hi mem size
;-> Syntax check for comma
;-> Get mnr less than 65536 to X
;Subtract one
;Higher than memory in system?
;-> ?OM ERROR if so

RETURN
01888 AE00 26 FD BNE $ABEF
01889 AE02 86 FF LDA #5FF
01890 AE04 97 3B STA <$3B
01891 AE06 BD ABF9 JSR $ABF9
01892 AE09 1F 14 TFR X,S
01893 AE0B 81 26 CMPA #526
01894 AE0D 27 0B BEQ $AEDA
01895 AE0F C6 04 LDB #4
01896 AE11 8C C60E CMPX #5C60E
01897 AE13 C6 0E LDB #50E
01898 AE15 7E AC46 JMP $AC46
01899 AE17 7E B277 JMP $B277
01900 AE1A 35 52 PULS A,X,U
01901 AE1C 9F 68 STX <$68
01902 AE1E DF A6 STU <$A6

DATA
01902 AE00 8D 06 BSR $ABE8
01903 AE02 8C 8D06 CMPX $8D06
01904 AE04 8D 06 BSR $ABEB
01905 AE07 39 STX <$A6
01906 AE08 C6 3A LDB #3A
01907 AE0A 86 5F LDA #5F
01908 AE0C D7 01 STB <1
01909 AE0E 5F CLR B,A
01910 AE10 9E A6 LDX <$A6
01911 AE12 1F 98 TFR B,A
01912 AE14 D6 01 LDB <1
01913 AE16 97 01 STA <1
01914 AE18 A6 84 LDA ,X
01915 AE1A 27 EC BEQ $AE77
01916 AE1C 34 04 PSHS B
01917 AE1E A1 E0 CMPA ,S+
01918 AE20 27 E6 BEQ $AE77
01919 AE22 30 01 LEAX 1,X
01920 AE24 81 22 CMPA #22
01921 AE26 27 EA BEQ $AEF1
01922 AE28 4C INCA
01923 AE2A 26 02 BNE $AF0C
01924 AE2C 30 01 LEAX 1,X
01925 AE2E 81 86 CMPA #586
01926 AE30 26 E7 BNE $AEF7
01927 AE32 0C 04 INC <4
01928 AE34 20 E3 BRA $AEF7

IF
01929 AF14 BD B141 JSR $B141
01930 AF17 9D A5 JSR <$A5
01931 AF19 81 81 CMPA #581
01932 AF1B 27 05 BEQ $AF22

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01983 AF81 89 00 ADCA #0
01984 AF83 DD 2B STD <$2B
01985 AF86 9D 9F JSR <$9F
01986 AF87 20 E2 BRA $AF6B

Assign variable value
01987 AF89 9D B357 JSR $B357
01988 AF8C 9F 3B STX <$3B
01989 AF8E C6 B3 LDB #B3
01990 AF90 BD B26F JSR $B26F
01991 AF93 96 06 LDA <6
01992 AF95 34 02 PSHS A
01993 AF97 BD B156 JSR $B156
01994 AF9A 35 02 PULS A
01995 AF9C 46 JSR $AF9C
01996 AF9D BD B148 JSR $B148
01997 AF9A 1027 0C8 LBEQ
01998 AFA4 9E 52 LDX <$52

Assign string to variable
01999 AFA6 DC 21 LDD <$21
02000 AFA8 10A3 02 CMPD 2,X
02001 AFA8 24 11 BHS $AFBE
02002 AFAD 9C 1B CMPX <$1B
02003 AFAD 25 0D BLO $AFBE
02004 AFB1 E6 84 LDB ,X
02005 AFB3 BD B50D JSR $B50D
02006 AFB6 9E 4D LDX <$4D
02007 AFB8 ED B643 JSR $B643
02008 AFB8 ED 0056 LDX #0056
02009 AFB6 9F 4D STX <$4D
02010 AFCD BD B675 JSR $B675
02011 AFC3 DE 4D LDU <$4D
02012 AFC5 9E 3B LDX <$3B
02013 AFC7 37 26 PULU A,B,Y
02014 AFC9 A7 84 STA ,X
02015 AFCE 10AF 02 STY 2,X
02016 AFCE 39 RTS

" ? REDO "
02017 AFCE 3F SWI
02018 AFD0 52
02019 AFD1 45
02020 AFD2 44
02021 AFD3 4F
02022 AFD4 0D 00 TST <0

02023 AFD6 C6 22 LDB #22
02024 AFD8 0D 6F TST <$6F
02025 AFD8 27 03 BEQ $AFDF
02026 AFD8 7E AC46 JMP $AC46
02027 AFD9 96 09 LDA <9
02028 AFE1 27 07 BEQ $AFEA
02029 AFE3 9E 31 LDX <$31
02030 AFE5 9F 68 STX <$68
02031 AFE7 7E B277 JMP $B277
02032 AFE8 8E AFCE LDX #AFCE

;In case of carry
;Save running total
;Parse next character
;Continue conversion

;-> Find or assign variable
;Hold variable pointer
;Token for "="
;Syntax check for "="
;Variable type

;-> Compute Variable
;Set flags in case string
;-> Type Mismatch check
;-> If nmbr, copy PPAC1 to var.
;-> Next string-stack pointer

;=> Stack top
;Already in hi mem?
;Leave alone if so
;String in BASIC text?
;Yes leave it
;Number of bytes
;-> Get next mem string ptr to <$56
;String varptr
;-> Copy string to memory
;Current RHS varptr

;-> Setup current string varptr
;Current RHS string varptr
;LHS string varptr
;String length=A, String ptr=Y
;Save length to variable
;Save string-pointer in variable

; ?
; R
; E
; D
; O
; CR, (end of message)

;Possible ?FD ERROR
;Is there keyboard-input?
;Yes
;Else ?FD ERROR if cassette
;INPUT or READ?
;If INPUT
;Current DATA line number
;=current line number
;Do " ?SN ERROR IN LINE nnnn"
;=> " ?REDO"-1

02081 B057 9E 35 LDX <$35
02082 B059 A6 84 LDA ,X
02083 B05B 26 0C BNE $B069
02084 B05D 96 09 LDA <9
02085 B05F 26 58 BNE $B0B9
02086 B061 BD 017C JSR $017C
02087 B064 BD B9AF JSR $B9AF
02088 B067 8D C6 BSR $B02F
02089 B069 9F A6 STX <$A6
02090 B06B 9D 9F JSR <$9F
02091 B06D D6 06 LDB <6
02092 B06F 27 27 BEQ $B098
02093 B071 9E A6 LDX <$A6
02094 B073 97 01 STA <1
02095 B075 81 22 CMPA #22
02096 B077 27 12 BEQ $B08B
02097 B079 30 1F LEXA -1,X
02098 B07B 4F CLR A
02099 B07C 97 01 STA <1
02100 B07E BD A35F JSR $A35F
02101 B081 0D 6E TST <$6E
02102 B083 26 06 BNE $B08B
02103 B085 86 3A LDA #3A
02104 B087 97 01 STA <1
02105 B089 86 2C LDA #2C
02106 B08B 97 02 STA <2
02107 B08D BD B51E JSR $B51E
02108 B090 BD B249 JSR $B249
02109 B093 BD AFA4 JSR $AFA4
02110 B096 20 06 BRA $B09E
02111 B098 BD BD12 JSR $BD12
02112 B09B BD BC33 JSR $BC33
02113 B09E 9D A5 JSR <$A5
02114 B0A2 81 2C BEQ $B0A8
02115 B0A2 81 2C CMPA #2C
02116 B0A4 1026 FF2 LBNF $AFD6
02117 B0A8 9E A6 LDX <$A6
02118 B0AA 9F 35 STX <$35
02119 B0AC 9E 2B LDX <$2B
02120 B0AE 9F A6 STX <$A6
02121 B0B0 9D A5 JSR <$A5
02122 B0B2 27 21 BEQ $B0D5
02123 B0B4 BD B26D JSR $B26D
02124 B0B7 20 95 BRA $B04E

Get next DATA
02125 B0B9 9F A6 STX <$A6
02126 B0BB BD AEE8 JSR $AEE8
02127 B0BE 30 01 LEXA 1,X
02128 B0C0 4D TSTA
02129 B0C1 26 0A BNE $B0CD
02130 B0C3 C6 06 LDB #6
02131 B0C5 EE 81 LDU ,X++
02132 B0C7 27 41 BEQ $B10A
02133 B0C9 EC 81 LDD ,X++

;Buffer/Data pointer
;Get data
;If got some data
;Input mode
;-> If End Data & READ, get more.
;-> RAM
;Print "?"
;-> Print "?"
;Save buffer pointer for parse
;Parse next character
;Variable type
;If numeric
;Parse-pointer
;Allowed delimiter
;Is it a quote?
;If not
;Else backoff pointer
;Zero as default string delimiter

;Initialize output parameters
;Cassette input?
;If so
;Use colon as delimiter
;Or comma

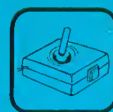
;-> String info to string-stack
;-> Align parse ptr to string end
;-> Assign string to variable

;-> Convert ASCII number to ACC1
;-> ACC1 to variable
;Parse current character
;-> If end of input
;Another value?
;-> If not, possible ?FD ERROR
;Save input for end check

;Restore BASIC parse pointer
;Parse current character
;-> If End Of line, check to see
; if end of input is OK
;-> Syntax check for comma
;-> And again

;Save pointer
;-> Get next statement
;Backoff pointer
;Is it end of line?
;If not
;Possible ?OD ERROR
;Next pointer pointer
;?OD ERROR if end of program
;Line number

```

16K Extended Color Basic

Orbit!

We've all wanted to fly one of those speedy little rocket numbers that are in all the Sci-fi movies. Here's your chance to captain a space ship.

by Tom Goodrick

SIMULATING COMPLEX engineering problems is a neat thing to do on a home computer; it's possible to learn something interesting while having fun. Of course, it's also easy to get bogged down in too many details. I intended Orbit to be more of a game than an educational program. I wanted to see if a space ship in orbit could really be con-

trolled 'by the seat of the pants' like an airplane, as they do in science-fiction instead of in the precisely-computed fashion of NASA. With just a little help from the computer it does seem possible.

In Orbit, you roughly control thrust direction, magnitude and burn time using a joystick and a button. The computer helps by providing a good real-time pic-

ture of the trajectory, and a few key data values. It also helps by automatically scaling the thrust to match the local gravity (which decreases as you get farther from the planet) and by providing the initial velocity needed to have a purely circular orbit. With this help all we need do is fire the engine various ways until we get the results we want.

To make things a little bit interesting, a space station is included with which we can rendezvous and dock. A landing target is randomly designated on the surface of the planet. Limited fuel is provided on board ship, which can be replenished only by docking with the space station. The planet has an atmosphere, and the space ship can be configured for either pure drag or a combination of lift and drag for a gliding re-entry.

Missions

Three missions can be selected with a tap of a key: launch from the surface; undocking from the station; and return from deep space. In each case, the program sets up all required starting condi-

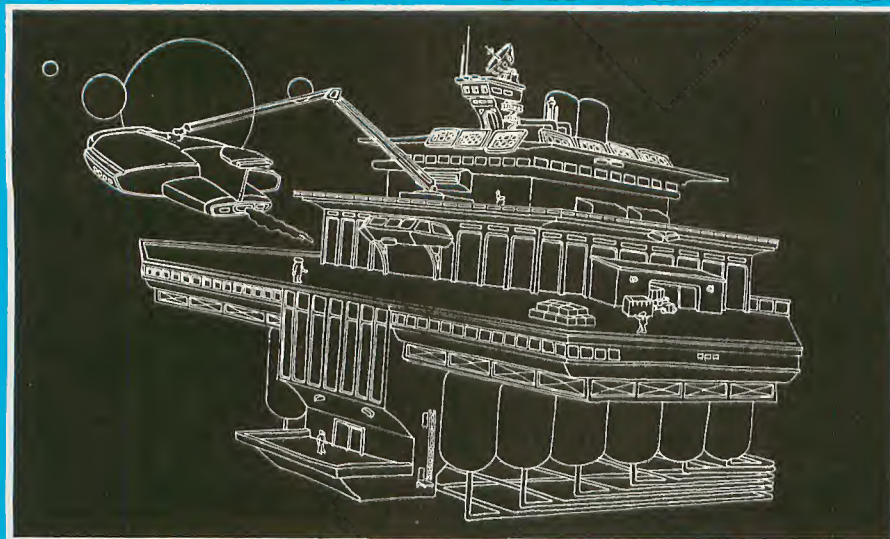


Illustration by Rod McCornick



Photo. Orbit — This shows one of the editor's many attempts to dock from a launch. The launch pad is at 9 o'clock, and the tracer tail shows a very aggressive launch to the altitude of the satellite in less than one-third of an orbit. Catching up to the station required some major course corrections. The station appears as the lone dot ahead of the end of the tracer.

tions, randomizing several of them. A fourth option is for entry of special conditions. Of course, since the entire program is in Basic (Extended Color Basic), the really venturesome user can change any parameter — the gravity field, the scale of the atmosphere, and so on.

Orbit is just complicated enough to require some instruction. This can be accomplished nicely by preceding the program by another program that displays instructional text. That way the instructions won't get separated from the program.

I developed a program (Listing 1a) that displays several pages of text with paging and indexing. The program is independent of the data statements which provide the text. After each page is displayed, the user can press the Enter key

to see the next page, or he can enter a page number and skip directly to that page, or he can enter any word or phrase and skip to the next page that contains that word or phrase. A fourth option is entry of the word LOAD, which automatically loads the game program following it on tape. The eleven essential program lines leave plenty of room for the text in data statements (Listing 1b).

The Orbit program (Listing 2) consists of an initial entry portion (Lines 1 – 160), a display set-up which is repeated if the plot scale is changed (Lines 170 – 220), and the action loop (Lines 230 – 1240). Four displays are presented: a text page to show running values of data (Lines 520 – 660), a trajectory plot (Lines 690 – 800), a view of the rectangular landing target in perspective (Lines 880 – 1110)

and a view of the circular space station (Lines 1120 – 1240).

Computations governing spacecraft motion are in Lines 340 – 440. Thrust input from the joystick is accepted in Lines 230 – 260 and modified for local gravity in Line 400. In Line 500, a key input is accepted "on the fly." L sets a lift body; D sets a high drag body; the space bar toggles the display between data and trajectory views.

To save the TV screen from image burn-in if the trajectory view remains on for several minutes, Line 750 causes a temporary shift to data text for a few seconds at intervals of about one minute. The equations for orbital mechanics are accurate with the solution based on the assumption that accelerations are con-

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stant over a small time interval. Resolving forces into x and y components makes computation easy. Aerodynamic forces for a stable point mass are accurately solved, though special effects of hypersonic and supersonic flight are ignored.

In Flight

To enter thrust controls, picture yourself — joystick in hand — facing away from the planet, and moving to your left. Set the thrust outward by moving the stick above center (forward). Increase your orbital speed by moving the stick left of center. With the stick set, hold the button in for as long as you want the engine to burn. In this way you may use either light thrust (stick near center) and long burn time or heavy thrust (stick away from center) fired in brief bursts for the same effect. Because the thrust is scaled to local gravity, large stick deflections can be used during lift-off and during docking.

Other control instructions are contained in the instructional text program. The best way to learn is to undock from the space station (option 2) and experiment watching both the trajectory view and the data.

When the spacecraft is moving without thrust, but with any combination of velocity components, it remains on some kind of orbit and will move around the planet, passing through the same starting point each time as long as the engine stays off and the ship stays outside the atmosphere (beyond a radius of 11000 units). By comparing the value of orbital velocity (VO) to the equilibrium value (VE), you can tell what will happen during the orbit. If $VO > VE$, then the craft will move further away from the planet (even if a negative radial component, VR, indicates it is temporarily moving toward the surface). If $VO < VE$, then the craft will move inward (drop closer to planet). Also note that VE increases as the craft moves inward. This makes angular position change much faster than when farther out. So, to catch up with the station, move to a low orbit; to let it catch up with you, move to a high orbit.

Orbit is not a fast-action arcade game; but it is interesting to try undocking, landing near the target, taking off, catching up with the station and docking without running out of fuel. Each orbit takes about ten minutes. It is challenging to try changing from one circular orbit to another. For a real challenge, try limping back from a mission in deep space with low fuel. ■ ■ ■

Program Listing 1a. Instructional Text Program

```
1 RESTORE: CLEAR 100: CLS: PMODE 0, 1:
  PRINT "SETTING PCLEAR5 NOW.": PCLEAR5: GOTO 10
5 CLS 4: PRINT @256, "PRESS <PLAY> BUTTON ON RECORDER. OK";: INPUT X$
6 CLS 0: PRINT @260, "NOW LOADING ORBIT";: CLOAD "ORBIT": END
10 PG=1: PO=1: GOSUB 100: CLS 0: PRINT @11, "PAGE";: GOTO 17
11 PRINT @480, CHR$(128);: PO=PG: LINE INPUT "enter/PAGE/WORD/LOAD?"; X$: CLSRND(8): PRINT @11, "PAGE ";
12 IF X$="" THEN PG=PG+1: GOTO 15 ELSE IF X$="LOAD" THEN 5
13 V=VAL(X$): IF V=0 THEN 19
14 PG=V: IF V>PM THEN CLS 2: PRINT @133, "THE LAST PAGE IS" PM;: GOTO 11
15 IF PG>PM THEN CLS 4: PRINT @260, "END OF TEXT";: PG=0: RESTORE: GOTO 11
16 IF PG<=PO THEN RESTORE
17 READ P, L$: IF P<PG THEN 17
18 IF P=PG AND L$<>"*" THEN PRINT L$: GOTO 17 ELSE IF P=PG AND L$="*" THEN 17 ELSE 11
19 READ P, L$: IF INSTR(L$, X$)=0 THEN IF P<=PM THEN 19 ELSE 21
20 PG=P: RESTORE: GOTO 17
21 RESTORE: IF PO>1 THEN PO=1: GOTO 19 ELSE PRINT @256, "DID NOT FIND": PRINT X$: GOTO 11
100 PM=12: RETURN
```

Program Listing 1b. Text in Data Statements

```
100 PM=12: RETURN
101 DATA 1, "1"
102 DATA 1, "***THESE ARE THE INSTRUCTIONS FOR THE GAME orbit."
103 DATA 1, "THESE INSTRUCTIONS CONSIST OF TWELVE PAGES OF TEXT. TO LOAD orbit, TYPE 'LOAD' AND PRESS THE <enter> KEY AT ANY PROMPT."
104 DATA 1, "TO SEE THE NEXT PAGE, PRESS THE <enter> KEY. TO SKIP PAGES JUST ENTER A PAGE NUMBER - TYPE THE NUMBER AND PRESS <enter>."
105 DATA 1, "THE TEXT IS FULLY INDEXED. ENTER A WORD OR PHRASE AND THE NEXT PAGE CONTAINING THAT WORD OR PHRASE WILL BE DISPLAYED."
```

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You made me do it.

I'm Dennis Kitsz. Every month you've asked me to design something for your TRS-80 Color Computer, TDP-100, or MC-10. Every month, I've done it. I can't resist — it's exciting. You asked me for true lowercase, RAM/ROM packs, battery backup, bubble memory mass storage, real-world interfaces, memory upgrades, unique software, and all sorts of special help.

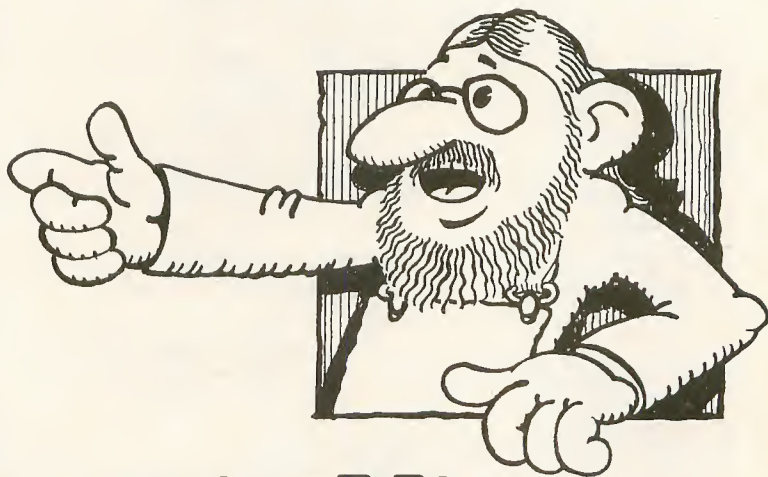
So I've put together a group of folks at Green Mountain Micro just to serve your needs. I've got the original Lowerkit for large, readable, uppercase and true lowercase characters. I have boxes of

CoCoPort interfaces, Color Sidecar RAM/ROM packs, and Color Burner EPROM programmers. Inexpensive 64K memory for the CoCo, 4K for the MC-10. Backpack battery backup, CPUs and spare parts. Bare boards, kits, assembled and tested. Software and technical help.

Now you've made me do it again. For five years, people have been asking, "Can you help me learn assembly language easily?". Here's my answer: yes, you can learn 6809 assembly language — and I'll guide you using Micro Language Lab. There are 25 lessons on tape, with examples you can load right into your Color Computer, plus a workbook. You can learn Z80 or 6502, if you like. Call or write Green Mountain Micro for information.

By the way. Keep making me do it. I love it.

- Lowerkit II, \$79.95 / \$49.95 kit
- 64K Color memory upgrade kit, \$49.95
- MC-10 added 4K upgrade kit, \$19.95
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Circle No. 34 on Reader Service Card

110 DATA 2,"*",2,"2"
 112 DATA 2," THE PLANET NEBULON, ORBITING CYGNUS 34, IS BEING EXPLORED BY A TEAM OF SPACE ADVENTURERS. IT HAS ATMOSPHERE LIKE EARTH'S, BUT DIFFERENT RADIUS AND MASS."
 114 DATA 2," THIS IS VERY CONVENIENT, AS ORBITING TIMES, SPEEDS AND ALTITUDES HAVE IDEAL MAGNITUDES FOR SIMULATION!"
 116 DATA 2," orbit IS AN ACCURATE SIMULATION, WITH AERODYNAMIC RE-ENTRY."
 120 DATA 3,"*",3,"3"
 122 DATA 3," A SPACE STATION ORBITS NEBULON AT A RADIUS OF 15000 WITH A SPEED OF 115 UNITS (CIRCULAR ORBIT). A LANDING ZONE ON THE SURFACE OF NEBULON IS MARKED BY A LINE ON THE PLANET."
 124 DATA 3," YOU MAY CHOOSE TO PERFORM VARIOUS MISSIONS INVOLVING DOCKING WITH THE STATION OR LANDING ON THE PLANET. WHEN YOU ARE CLOSE TO EITHER ONE, YOU'LL SEE A PICTORIAL VIEW."
 130 DATA 4,"*",4,"4"
 132 DATA 4," FOR ORBITAL MANEUVERS, SWITCH FROM TRAJECTORY TO DATA VIEWS BY TAPPING THE <space> BAR. THE DATA VIEW WILL HELP YOU ACHIEVE A PERFECT ORBIT."
 134 DATA 4," 'POLAR ANGLE' DATA IS YOUR POSITION (IN DEGREES) FROM THREE O'CLOCK, COUNTERCLOCKWISE. 'VO' IS YOUR SPEED IN THE ORBITAL DIRECTION. 'VE' IS THE 'VO' NEEDED FOR CIRCULAR ORBIT."
 136 DATA 4," 'VR' IS YOUR VERTICAL SPEED, RELATIVE TO PLANET CENTER."
 140 DATA 5,"*",5,"5"
 142 DATA 5," USE THE RIGHT JOY STICK AND BUTTON TO CONTROL THRUST. TO USE THRUST, PUT YOURSELF ON THE SHIP FACING AWAY FROM THE SURFACE."
 146 DATA 5," PUSHING THE STICK FORWARD PUSHES THE SHIP AWAY FROM THE PLANET (SHOWN AS POSITIVE TR). PUSHING IT LEFT GAIN

S ORBITAL SPEED. THE ENGINE FIRES WHILE THE BUTTON IS HELD IN. MAXIMUM THRUST OCCURS WITH STICK AWAY FROM CENTER."
 150 DATA 6,"*",6,"6"
 152 DATA 6," USE LOW THRUST FOR LONG TIMES OR HIGH THRUST IN SHORT BURSTS. MAXIMUM THRUST IS LIMITED TO 1.4 TIMES LOCAL GRAVITY, SO YOU MAY USE LARGE STICK DEFLECTIONS REGARDLESS OF THE RADIUS."
 154 DATA 6," NOTE THAT THRUST IS LIMITED WHEN USING THE LIFTING BODY, TO ALLOW PROPER THRUST FOR CRUISING AND MODERATE CLIMBING. SWITCH TO THE DRAG BODY WHEN YOU NEED HIGH THRUST. USE THE DRAG BODY FOR"
 156 DATA 6," LIFT OFF. DRAG IS LOWEST WHEN CLIMBING."
 160 DATA 7,"*",7,"7"
 162 DATA 7," NOTICE THAT THE SPEED FOR A CIRCULAR ORBIT (VE) IS GREATER CLOSE TO THE PLANET. USE THIS TO CATCH THE STATION. GO TO LOWER ORBITS WHEN IT'S AHEAD, AND HIGH ONES TO LET IT CATCH UP."
 164 DATA 7," ATMOSPHERE EXTENDS TO 10000. ORBITS THIS LOW DECAY, SO TO DELAY IT, USE THE LIFTING BODY. PRESS <L> FOR THE LIFTING BODY, <D> FOR THE DRAG BODY SHIP."
 166 DATA 7," TO 'SKIP' ON THE ATMOSPHERE, USE LIFTING BODY, THEN DRAG."
 170 DATA 8,"*",8,"8"
 172 DATA 8," 'Q' IS THE PRESSURE OF THE AIR AS YOUR SHIP DROPS INTO THE ATMOSPHERE. A 'BEEP' TONE WARNS OF THE MAGNITUDE OF Q, INCREASING WITH SPEED AND DENSITY. KEEP BELOW 500 TO AVOID BURNING UP."
 174 DATA 8," FOR SURFACE LAUNCH USE FULL THRUST ONLY TO START. CUT BACK THRUST TO KEEP Q LOW AND SAVE FUEL. ONLY THE STATION CAN REFUEL YOUR SHIP."
 176 DATA 8," TO DOCK, KEEP THE STATION CENTERED AS YOU SLOWLY APPROACH WITH THRUST OFF."
 180 DATA 9,"*",9,"9"



Unlock the full potential of your color computer

It's easy with the right keys.

The HJL-57 professional keyboard instantly upgrades your TRS-80* Color Computer to a dependable, high-performance machine with all the capabilities of systems costing hundreds more.

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A real keyboard with all the feel and response to make you more confident and reduce input errors. Sculptured, low-profile keycaps are ergonomically designed to cut fatigue and improve typing speed.



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Including the F-version and TDP-100.* Layout is identical to original CoCo keyboard **PLUS** four software-definable function keys (one latchable), specially positioned to avoid inadvertent actuation.

Built for heavy use

Manufactured under contract by a leading U.S. OEM, with

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Anyone can remove the old keyboard and easily install the HJL-57 in just a few minutes, and the kit includes a new bezel for a totally finished conversion.

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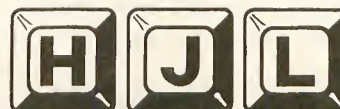
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Function keys	Four (one latching)	None	Four
Low-profile, sculptured keycaps	Yes	No	No
Spill-proof contacts	Yes	No	No
RFI/EMI shielding	Yes	No	No
Contact rating	100 million cycles min.	Not specified	Not specified
Money-back guarantee	Yes	No	No

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Circle No. 36 on Reader Service Card

182 DATA 9," TO UNDOCK, THRUST
BACKWARDS SLIGHTLY (STICK RIGH
T) UNTIL YOUARE CLEAR (OVER 100
UNITS AWAY).TO DOCK AGAIN YOU MU
ST MOVE AWAY1000 UNITS BEFORE RE
-APPROACH."

184 DATA 9," ",9," AT THE DATA
VIEW, CHANGE THE SCALE OF THE T
RAJECTORY PLOT BY PRESSING <S>.
THE SCALE IN USE IS PRINTED FOR
REFERENCE. NOTE THAT THE TRAJE
CTORY IS ERASED WHEN YOU CHANG
E THE SCALE."

190 DATA 10,"*",10,"10"

192 DATA 10," THE EASY WAY TO
CHANGE CIRCULAR ORBITS: FI
RE THRUST IN ORBITAL DIRECTION O
NLY (KEEP STICK VERTICALLY CE
NTERED). YOU WILL THEN MOVE ALON
G AN ELLIPSE. TO MOVE FARTHER
OUT, FIRE FORWARD THRUST UNTI
L 'VO' IS"

194 DATA 10,"GREATER THAN 'VE'.
COAST UNTIL 'VR' AGAIN BECOMES
ZERO. THEN FIRE THRUST AGAIN
TO BRING 'VO'UP TO 'VE'. USE THE
OPPOSITE PROCEDURE TO MOVE L
OWER."

200 DATA 11,"*",11,"11"

202 DATA 11," IN OPTION 4, SET
ANY INITIAL CONDITIONS DESIRED.
ENTER VALUESFOR F (FUEL), X AND
Y POSITION (ANGLE, RADIUS), U
(X VELOCITY) AND V (Y VELOCITY)
WITH X AND Y ORIGINS AT CENTER A
ND V>0 MOVINGUP."

204 DATA 11," YOU MAY SET ANY
RADIUS FOR THE STATION ORBIT.

ITS SPEED IS CALCULATED AUTOM
ATICALLY."

206 DATA 11," ",11," THE EASIE
ST OPTION TO START WITH IS OPTI
ON 2: UNDOCKING WITHTHE STATION.
"

210 DATA 12,"*",12,"12"

212 DATA 12," orbit IS WRITTEN
ENTIRELY IN BASIC. THOSE INTERE
STED MAY FINDTHE FORM OF ORBITAL
EQUATIONS INTERESTING. FORCES
ARE RESOLVEDIN A SIMPLE BUT COR
RECT XY FORM,RATHER THAN THE POL
AR FORM MORE OFTEN USED. AERODYN
AMIC FORCES"

214 DATA 12,"ARE CORRECT FOR A P
OINT-MASS TRAJECTORY WITH FIX

ED LIFT AND DRAG COEFFICIENTS,
BUT THERMAL AND MACH EFFECTS ARE
IGNORED."

216 DATA 12," ENTER 'RUN2' TO
RESET NORMAL SPEED AFTER USING break
TO STOP."

220 DATA 13,"*",13,"13" ---

Program Listing 2. Orbit

```

1 CLS3:PRINT@268,"ORBIT";:PCLEAR
5:GOTO10
2 POKE65494,0:END
10 FOR T=1TO600:NEXT T
30 DIM XC(4),YC(4)
40 K=0.0025:D1=0.02:D2=0.2:PI=3.
141592653:AF=180/PI:G=8:R0=5000:
HI=65495:LO=65494
45 HI=LO
50 PRINT@64," WHILE ORBIT IS RU
NNING, PRESS L -LIFTING BODY, D
-DRAG BODY, S -SCALE CHANGE, <
space bar> SWITCHES BETWEEN O
RBIT AND DATA VIEWS."
60 KD=D2:LD=0:DT=1:RS=15000:VS=R
0*SQR(G/RS)
70 I6$="#####":I3$="#####":I2$="
##.##"
80 PRINT:PRINT" SELECT TYPE OF M
ISSION":PRINT" (1) LAUNCH TO ST
ATION":PRINT" (2) LAND FROM STAT
ION":PRINT" (3) RETURN FROM DEEP
SPACE (4) SPECIAL"
90 INPUT" YOUR SELECTION";S:IF S
<1 OR S>4 THEN 90
100 ON S GOTO1250,1260,1270,110
110 INPUT" F,X,Y,U,V";F,X,Y,U,V
120 INPUT"STATION RADIUS";RS:INP
UT"SCALE (NORM=170)";SC
130 DS=R0*SQR(G/(RS*RS*RS))
140 AS=0:RX=1000:R=5005
150 AL=(-180+RND(360))/AF:CLS3
160 POKE HI,0
170 PMODE 3,1
180 PCLS:CIRCLE(128,96),2*R0/SC,
6:PAINT(128,96),6,6
190 CIRCLE (128,96),R0/SC,7
200 PAINT (129,97),7,7
210 XL=128+(R0/SC)*COS(AL):YL=96
-(R0/SC)*SIN(AL)

```

◆ next page

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220 COLOR 6,5:LINE(128,96)-(XL,Y
L),PSET:PMODE4,1:SCREEN1,1
230 TA=1.4*(JOYSTK(0)-32)/32/(1+
LD)
240 TR=1.4*(32-JOYSTK(1))/32/(1+
LD)
250 BT=PEEK(65280)
260 IF(BT AND 3)<>2 THEN TR=0:TA=0
270 Q=0.5*DN*VT*VT
280 IF Q>2 AND Q<510 THEN POKELO,0:
SOUND (Q/2),1:POKEHI,0
290 IF Q>QM THEN QM=Q:HM=R-R0:VM
=VT ELSE IF Q<.1 THEN QM=.1:HM=0
:VM=0
300 F=F-0.4*SQR(TA*TA+TR*TR)*G*R
0*R0/(R*R)
310 IF F<0 THEN TR=0:TA=0
315 X=X+U/2:Y=Y+V/2:R=SQR(X*X+Y*
Y):U1=U:V1=V
320 IF R>11000 THEN 400
330 IF(R-R0)<3 AND TR=0 THEN U=0:V=
0:GOTO 450
340 IF R<6000 THEN IF ABS(AL-O)<
0.17 THEN DT=-(DT=1)-3*(DT>1)
350 IF RX<100 AND TA=0 THEN 450
360 DN=EXP(K*(R0-R))

```

```

370 VT=SQR(U*U+V*V):IF LD=0 THEN
IF VR>0 THEN KD=D1 ELSE KD=D2
380 U1=U-(U-LD*V)*KD*DN*VT/2
390 V1=V-(V+LD*U)*KD*DN*VT/2
400 T1=G*R0*R0/(R*R*R):TA=TA*R0*
R0/R/R:TR=TR*R0*R0/R/R
410 CO=X/R:SI=Y/R
420 U=U1+G*(TR*CO+TA*SI)-X*T1
430 V=V1+G*(TR*SI-TA*CO)-Y*T1:VO
=V*CO-U*SI:VR=V*SI+U*CO
440 X=X+U/2:Y=Y+V/2
450 AS=AS+DS:AS=AS+6.28*(AS>3.14
)
460 X3=RS*COS(AS):Y3=RS*SIN(AS)
470 DX=X-X3:DY=Y-Y3
480 RX=SQR(0.1+DX*DX+DY*DY):IF D
K=0 THEN IF RX<1000 AND O<=AS TH
EN DT=1-3*(DT>1):IF RX<100 THEN
DT=1:DK=1
490 DK=-DK*(RX<1000)
500 IN$=INKEY$:IF IN$="D" THEN K
D=D2:LD=0 ELSE IF IN$="L" THEN K
D=D1:LD=3 ELSE IF IN$=" " THEN D
T=- (DT>1)-(DT=1)*2
510 ON DT GOTO 520,690,690,690
520 PRINT@32,"RADIUS=";:PRINTUSI

```

♦ next page

Table 1. Variables for Orbit

Name	Line	Definition	Name	Line	Definition
AL	150	Angular Position of Landing Area	RX	140	Distance to Station
AS	140	Station Angular Position	S	90	Option Selected
BT	250	Button Reading	SC	830	Scale Factor for Plot
CO, SI	410	Cosine, Sine of Angular Position	T	10	Index for Time Delay
D1	40	Drag Coefficient of Life Body	T1	400	Acceleration Coefficient
D2	40	Drag Coefficient of Drag Body	TA	230	Orbital Comp of Thrust
DK	480	Docking Indicator	TR	240	Radial Comp of Thrust
DN	270	Density	TS	740	Counter for Screen-Saving Text
DS	130	Change in Station Angular Position	U	110	X Component of Velocity
DT	340	Variable Controlling Display	U1, V1	380	Intermediate Values of U and V
F	110	Amount of Fuel	V	110	Y Component of Velocity
G	40	Gravity at Surface	VE	560	Orbital Speed for Circular Orbit
I6\$	70	Numeric Format String	VO, VR	430	Orbital, Radial Vel Components
IN\$	500	Tapped Key Input	VS	60	Speed of Orbiting Station
K	40	Sets Density Versus Altitude	VT	270	Total Speed of Ship
KD	60	Drag Coefficient in Use	X	110	Space Location Right of Center
LD	60	Lift Drag Ratio in Use	X3, Y3	460	Station Coordinates
M (Suffix)	290	Condition at Max Q	X4, Y4	760	Old Plot Coords of Station
O	530	Polar Angle of Ship's Position	XC ()	30	X Pos of Landing Rectangle
PI	40	The Constant 'Pi'	XL&YL	210	Coordinates of Landing Area
Q	270	Dynamic Pressure	XP, YP	700	Plot Coords of Ship
R	140	Radial Position of Ship	XS, YS	710	Plot Coords of Station
R0	40	Radius of Planet	Y	110	Space Location Above Center
RS	60	Radius of Orbit of Station	YC ()	30	Y Pos of Landing Rectangle

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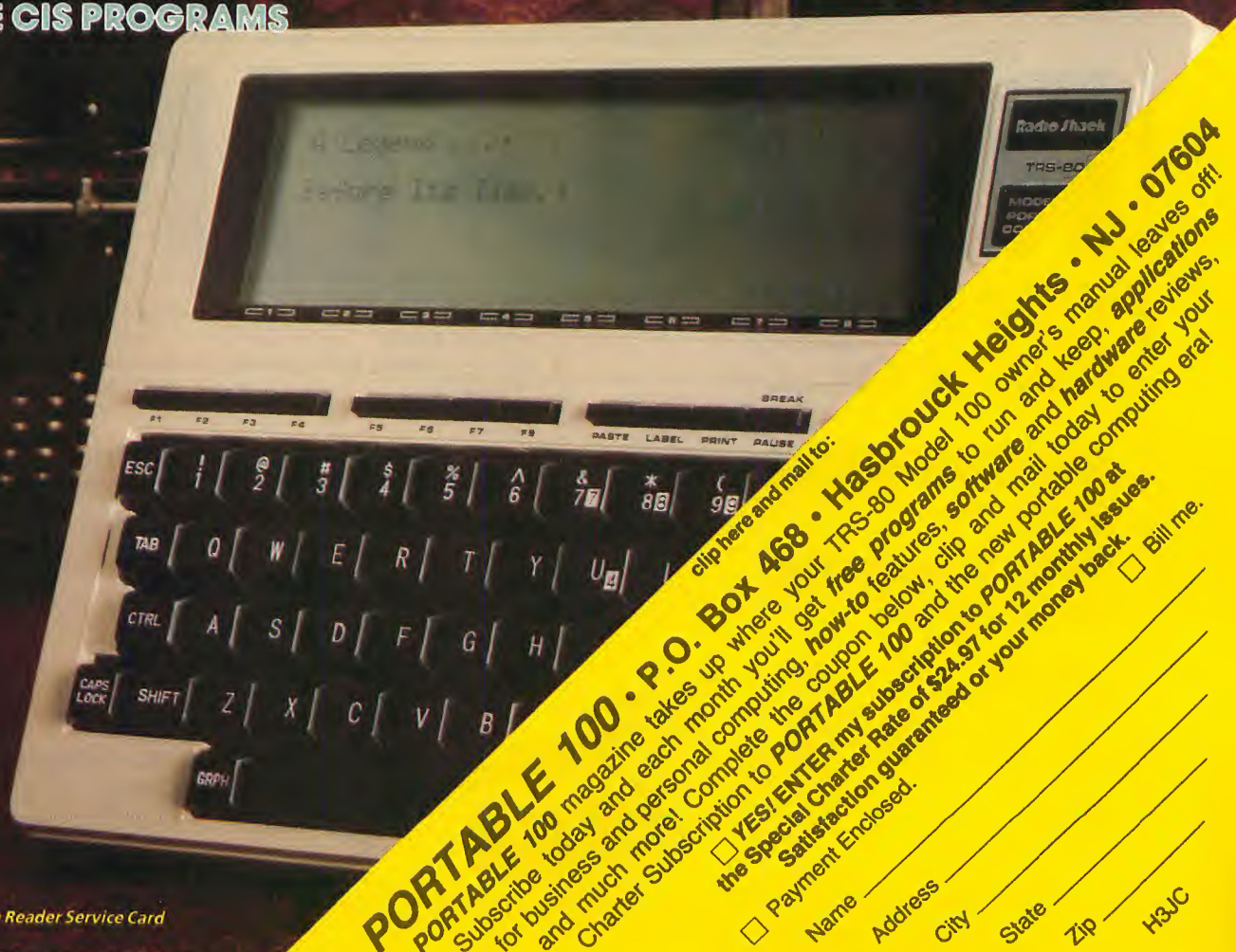
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```

NGI6$;R:PRINT"ALTITUDE=";:PRINTU
SINGI6$;R-R0
530 O=ATN(Y/X):IF X<0 THEN O=PI*
SGN(Y)+O
540 PRINT"POLAR ANGLE=";:PRINTUS
INGI3$;O*AF
550 PRINT"DIST TO LZ=";:PRINTUSI
NGI6$;R*(AL-O)
560 VE=R0*SQR(G/R):PRINT"VO=";:P
RINTUSINGI3$;VO;:PRINT"      VE=
";:PRINTUSINGI3$;VE
570 PRINT"VR=";:PRINTUSINGI3$;VR

580 PRINT"TO=";:PRINTUSINGI2$;-T
A
590 PRINT"TR=";:PRINTUSINGI2$;TR

600 IF LD=0 THEN PRINT"DRAG BODY
" ELSE PRINT"LIFTING BODY"
610 PRINT"Q=";:PRINTUSINGI3$;Q
620 PRINT"MAX Q="INT(QM)"AT H="I
NT(HM)"& V="INT(VM)
630 PRINT"FUEL=";:PRINTUSINGI6$;
F
640 PRINT"STATION RANGE=";:PRINT
USINGI6$;RX

```

```

650 IF RX<100 AND TA=0 THEN PRIN
T"DOCKED":F=1000:X=X3:Y=Y3:U=-RS
*DS*SIN(AS):V=RS*DS*COS(AS) ELSE
PRINT"PRESS space FOR TRAJECTOR
Y"
660 IF IN$="S" THEN 830
670 ON DT GOTO 690,680,880,1120
680 FOR T=1 TO 800:NEXT T
690 PMODE 4,1:IF DT=2 THEN SCREE
N 1,1
700 XP=X/SC+128:YP=96-Y/SC
710 XS=X3/SC+128:YS=96-Y3/SC
720 XP=XP*(XP>0)*(XP<255)-255*(X
P>=255)
730 YP=YP*(YP>0)*(YP<191)-191*(Y
P>=191)
740 TS=TS+1
750 IF TS>50 THEN TS=0:GOTO 520
760 PRESET(X4,Y4):X4=0:Y4=0
770 IFXS<0ORXS>255ORYS<0ORYS>191
THEN800
780 PSET(XS,YS,1)
790 X4=XS:Y4=YS
800 PSET(XP,YP,1):ON DT GOTO 230
,230,880,1120
810 PMODE 4,1:SCREEN 1,1

```

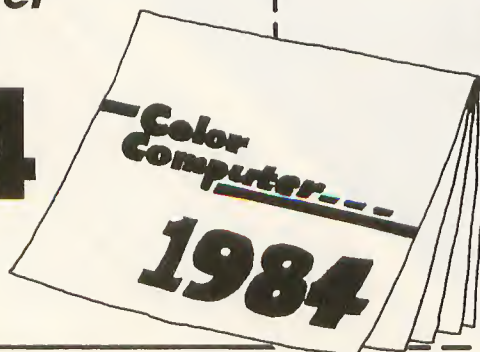
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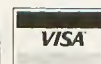
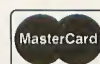


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```

820 RETURN
830 PRINT "NOW SCALE="SC:INPUT"SC
ALE";SC:CLS3
860 DT=2
870 GOTO170
880 PMODE 0,5:SCREEN 1,0
890 RL=R0*(AL-O):H=R-R0
900 IFH<1THENH=1
910 XC(2)=128+(25/(RL+25))*10
920 YC(2)=96+(H/(RL+25))*10
930 XC(3)=128+(25/(RL-25))*10
940 YC(3)=96+(H/(RL-25))*10
950 IFRL<-99THENXC(2)=255:YC(2)=
190
960 IFRL<25 THENXC(3)=255:YC(3)=
190
970 IFXC(2)>255THENXC(2)=255
980 IFYC(2)<0THENYC(2)=0
990 IFYC(3)<0THENYC(3)=0
1000 IFXC(3)>255THENXC(3)=255
1010 IFYC(3)>190THENYC(3)=190
1020 IFYC(2)>190THENYC(2)=190
1030 XC(1)=255-XC(2):YC(1)=YC(2)
1040 XC(4)=255-XC(3):YC(4)=YC(3)
1050 PCLS
1070 FORI=1TO4:J=I+1

```

```

1080 IFJ=5THENJ=1
1090 LINE(XC(I),YC(I))-(XC(J),YC
(J)),PSET
1100 NEXT I
1110 GOTO230
1120 PMODE 0,5:SCREEN 1,0
1150 S=200/RX
1160 YP=96-(RS-R)*S
1170 PCLS
1190 IF YP<0ORYP>190OR(32*S)>128
THEN1240
1200 LINE(128-32*S,YP)-(128+32*S
,YP),PSET
1210 CIRCLE(128,YP),40*S
1220 CIRCLE(128,YP),32*S
1230 CIRCLE(128,YP),8*S
1240 GOTO230
1250 X=-R0:Y=-1:U=-0.1:V=0:SC=17
0:F=700:GOTO130
1260 X=RS:Y=0:U=0:V=VS:SC=170:F=
1000:GOTO130
1270 F=400+10*RND(50):X=SGN(RND(
2)-1.5)*(12000+80*RND(200)):Y=SG
N(RND(2)-1.5)*(12000+80*RND(200)
):U=-X/2000:V=-Y/2000:R=SQR(X*X+
Y*Y):SC=R/90:GOTO130

```

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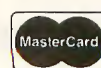
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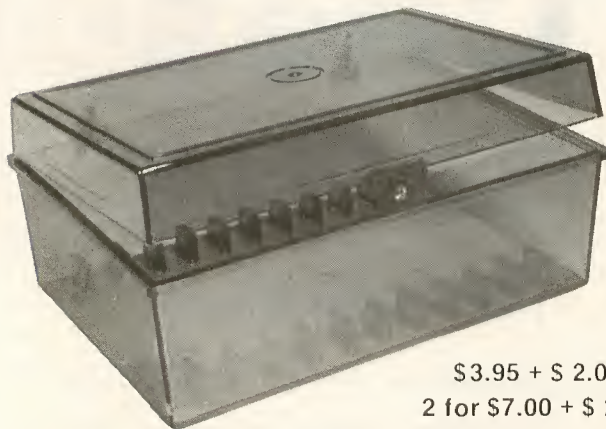


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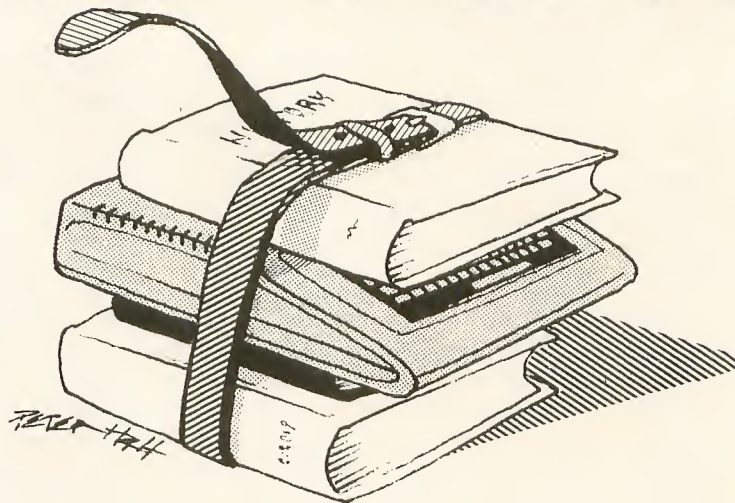
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GOTO SCHOOL



DON'T BELIEVE it will be an idle prediction if I say this will be the biggest year ever for educational use of the Color Computer. It seems like every month something new concerning the Color Computer comes up. I receive many calls and letters from excited Color Computer users who need more information about the educational use of the computer, or have suggestions and ideas about how they are using it in the schools, or from programmers who want to write educational software.

Databases

One component of computer education that has not received much attention is the database. Most schools have not become involved with a database such as CompuServe because of the expense of prime-time use. Also, many educators are unfamiliar with the services available from databases. There are some resources you might find helpful when researching database use for your school.

An excellent book, *Focussing on Teletext and Videotex*, is available from the McGraw-Hill Book Company. This book analyzes the growing technology and potential of Teletext and Videotex in the United States over the next ten to twenty

by Dr. Paul Kimmelman

years. The book contains an introductory section which explains Teletext and Videotex in detail. There is also an interesting treatment of policy issues — copyright and content regulation.

The book is part of the Data Communications Book Series and contains plenty of interesting reading.

Another source of information on data communications can be obtained from Computerware (P.O. Box 668, Encinitas, CA 92024, telephone (619) 436-3512). This source is a computer program available on cassette or disk, that runs in four basic parts, each explaining a different aspect of data communication.

Finally, to help everyone become more familiar with a database, I will write on a regular basis about some of the services available from CompuServe in Columbus, Ohio. CompuServe has an education menu and also an informative Color Computer service, among many other interesting informational opportunities.

I believe we will soon begin to see an impact on education made by databases such as CompuServe. When one equates

education with information retrieval, it only makes sense to look to databases as a source of such information.

More on this next month.

Electronic Notebook

Radio Shack is about to brighten up the lives of Color Computer users with "Professor Pressanote's Music Machine." This program was prepared for Radio Shack by Spectrarts UK.

"Professor Pressanote's Music Machine" is a notebook that plugs into your joystick port. It uses page inserts and pressure on various areas on the page to create music or listen to already programmed tunes.

This is one of the most exciting educational entries into the Color Computer software market I've seen. While "Pressanote" in and of itself would be a dramatic software package, the curricular potential for the "Electronic Notebook", of which "Pressanote" is a part, is unlimited.

Another important aspect of the electronic notebook concept is that costs will be reasonable. Additional programs should be developed frequently and made available for approximately \$20-25.

♦ next page

MECC

A significant announcement for schools is the Radio Shack participation with the Minnesota Education Computing Consortium. This will make a considerable amount of TRS-80 compatible software available at a reduced cost through an MECC membership. While specific details have not yet been announced, it would seem likely that software for the Color Computer will be included in the program.

Early Childhood Education

Along with the positive benefits gained in education from computer use, there is still a negative impact caused by parents and educators whose intentions are positive, but the results potentially harmful. The same phenomenon of the over-zealous Little League coach can exist with computer use. This is meant simply to caution adults that some children may not be ready to work with computers. Because of the publicity computers receive, many adults believe it is a "must" activity for their students or children. How many youngsters were forced to go to a computer camp last summer?

Especially when working with young children, it is extremely important to use

caution. A young child would be in the 4-to-6 year old range. First look for signs that these children are interested in the computer: Does the child appear to enjoy the activity? Does he remain interested for an extended period of time? Most children do not have long attention spans and do not remain involved in one activity for long. If they appear interested in the computer activity, let them continue. If they appear to lose interest, *don't force them to continue*. You can always come back and start over or pick up where you left off. Try to make this educational activity a normal and interesting experience. Avoid pressuring the child!

What types of software you should use to introduce a child to computing is a question I am frequently asked. I like to suggest that you begin by offering a simple game activity, like Radio Shack's "Popcorn" program. "Popcorn" is simple, uses directions, and helps the child become familiar with the computer.

After an initial encounter period with the computer, you can begin working on academics. If programming is part of the plan, using Logo in the doodle mode would be an excellent start.

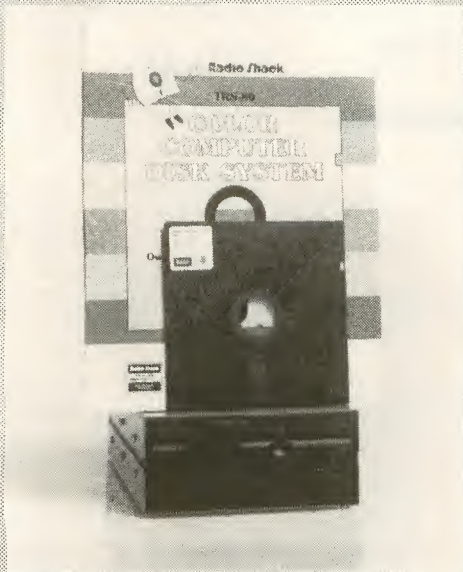
Supplementing early childhood curriculum is also an appropriate activity. For the kindergarten-aged child, look for software that introduces shapes, colors,

numbers, letters, words, and clocks. For added enjoyment and the fine arts, look for music and drawing programs.

There is a rapidly growing number of educational software developers for the Color Computer. For early childhood math and spelling, some excellent programs are made available by Dr. Max Jerman of Bertamax, Inc. The Follett Library Publishing Co. has translated the highly-acclaimed Learning Company software (originally marketed for Apple) for the Color Computer. For young children, I especially recommend the award-winning "Juggles Rainbow," "Bumble Games," and "Bumble Plot." In the near future Follett will also offer "Magic Spells."

For creative thinking, a program offered by Follett is "Moptown." Between "Moptown" and Logo there is an abundance of cognitive opportunities for the young computer learner. "Moptown" has excellent graphics and will surely captivate the child's attention.

A newcomer to the Color Computer educational market is Early Games in Minneapolis, Minnesota. Early Games produces software for young children. The only offering thus far for Color Computer users, called "Early Games," is a fine product (see review section). Early Games programs are for home educators



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and not intended for schools; however, I would be comfortable seeing this program in a kindergarten or first grade.

I have listed only a sampling of some of the finer software: there is more available. I will update the early childhood software as it becomes available. Radio Shack has exciting plans for software that will be highly motivating for home and school use.

I also receive many inquiries concerning how to use the computer in elementary schools. The Color Computer seems to have enjoyed its greatest popularity in elementary schools, yet there are some fine programs available for high school students.

I am not certain there is a "best" configuration for computers in the schools. While a lab setting is most appropriate, it may be equally as important to be able to move computers from room to room. At this stage of computer use in our schools, it seems mobility should be a priority. Until there are classroom labs with 15 - 20 computers, and more computers that can be moved from classroom to classroom, it will be essential to maintain flexibility.

Equally important is the problem of multi-story school buildings without elevators. Obviously, 5 and 6 year old children cannot carry televisions up and

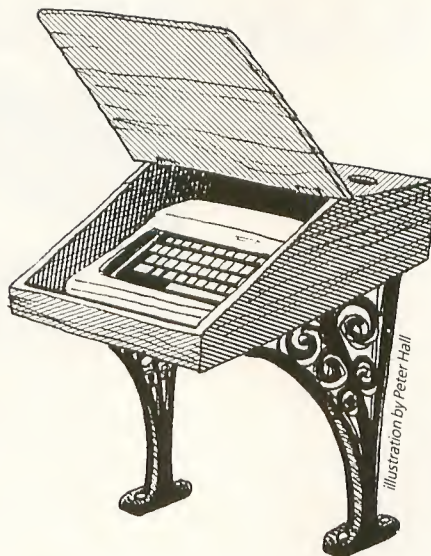


Illustration by Peter Hall

down stairs. In these instances computers on mobile carts may be the solution. But don't look for "expert" answers to all your problems; explore several alternatives until you find a method that is comfortable for your situation.

Field Testing

Next month we will have a review of a clock program written by David Kalman

of Crystal Software. David's program isn't so much *better* than other clock programs, but the effort he put in it to make it more practical for school use is laudable. David's story is especially interesting because he is just starting to write software for the Color Computer. He asked me to look at and critique his clock program. After reviewing his program with some of my colleagues, we decided it would not meet our criteria for classroom use. Rather than give up, David made several major changes and sent us the program to review one more time. He now has a fine clock program.

Since I have mentioned David's clock program, I should call your attention to two other excellent clock software packages, created by B-5 and Tom Mix.

It is important to look for educational software that has been field-tested. Teacher and student opinions are critical to creation of excellent educational software. Look for reviews that address your needs.

Logo

As we move into the school year, it is apparent that Logo is becoming increasingly popular. Why not? It is easily learned and students are treated with rapid

♦ to page 82

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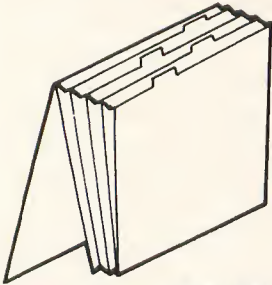
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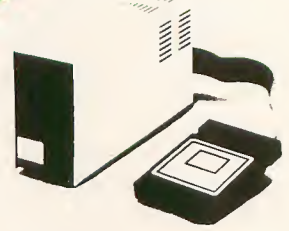
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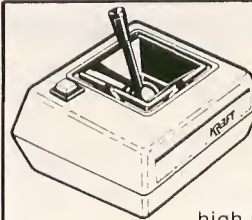
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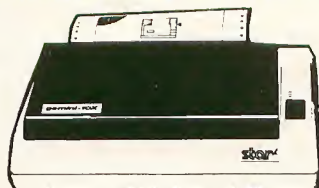
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success in their projects. Rather than write about Logo this month, I thought I would share a program written by John Charlton, a student in George Gerhold's Western Washington University computer literacy class. It is one of the most interesting Logo programs I have seen. Despite its length, it is truly worth studying.

Periodically I will provide you with some of the Logo programs Gerhold's students have written. You may want to send me some of your student's work, or even some of your own.

Reminder

Don't forget our direct GOTO School address:

Dr. Paul Kimmelman
Education Editor — Color
Computer Magazine
P.O. Box 8276
Akron, Ohio 44320

Be sure to send your questions, suggestions, criticisms, ideas, programs, and anything else to help make this column your Color Computer educational forum. Please include a cassette or disk if you want a program reviewed.

Next Month

The school district where I work was selected to become a demonstration site for a model computer lab in a middle

school by the Gusdorf Furniture Company. I will provide you with suggestions and ideas on how to develop a computer lab in schools, or even what type of furniture is available for your home. Also, more discussion on Logo. We will take a look at some of its successes, and criticisms from its users.

Also, thoughts on computer education for students in grades three and four, the lower intermediate grades. What should be done to build on what was taught in the early childhood programs? ■ ■ ■

A Special Education Editorial

THOSE OF US WHO use the Color Computer for educational purposes should hold our heads high. The arrival of excellent educational software has long been awaited. In the past it may have been fair to criticize Radio Shack's education department for not supplying schools with desperately needed software. Not now! My compliments go to Bill Gattis, Radio Shack's Education Division Director, and his staff for making 1983 a bright year for the Color Computer educational future. Radio Shack's economical Logo version more than meets the needs of young children.

Many of its features make it something special.

I recently spent two days with George Gerhold, co-author of Color Logo. Time spent watching Dr. Gerhold work on Color Logo proves there are countless educational applications for it. There is no limit to the creative opportunities available. (Logo was developed at the Massachusetts Institute of Technology, not by a microcomputer company.)

A quick review of Radio Shack's new educational software demonstrates that many new doors to curriculum use will be opened. The products include Color Math, Color Calculus, Vector Math, The Illustrated Computer, Professor Pressnote, and outstanding Children's Computer Workshop programs.

Other commendations: Andy Larson from Follett Library Publishing Company assumed a financial risk by converting excellent educational programs (by the Learning Company) for the Color Computer. Fortunately, it was a success. We now have "Magic Spells" available, the most difficult of the programs to convert. The list could go on. The Color Computer has come of age for education, and its future is bright. It is no longer necessary to be defensive about being a Color Computer user, if you ever were. ■ ■ ■

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No longer do you have to sacrifice valuable memory and strained eyesight to expand the video display of your computer. Just plug the WORD-PAK* into the ROM port and get a high quality 80 column video display comparable to the high priced terminals. Software, included with the board, provides terminal functions, programmable screen formats (for compatibility with other computers), and screen editing capabilities. You can use it with most of your Basic programs or add the Flex Patch (below) to run all those Flex programs that require an 80 column display. Available for cassette or disk based systems (disk systems require the use of a Y-connector or expansion bus).

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*The WORD-PAK produces a composite video signal and requires the use of a monitor capable of displaying 80 columns of text.

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Program Listing. To Project, by John Charlton

```
TO PROJECT
MASTER 1 2
END
TO MASTER :B :0
SLOW 0 HT
SCENE :B :0
FIGHT :B :0
END
TO SCENE :B :0
CLEAR HT
COLORSET 1 BG 0
PENCOLOR :B
SX 2 SY 0
RT 90 FD 250
SX 2 SY 25
FD 250
SX 2 SY 50
FD 250
SX 2 SY 70
FD 250
SX 2 SY 88
FD 250
SX 2 SY 103
FD 250
SX 2 SY 115
FD 250
```

```
SX 2 SY 125
FD 250
LT 90
SX 2 SY 120 RT 51 FD 6 LT 51
SX 2 SY 113 RT 48 FD 17 LT 48
SX 2 SY 101 RT 45 FD 32 LT 45
SX 2 SY 87 RT 41 FD 50 LT 41
SX 2 SY 67 RT 37 FD 71 LT 37
SX 2 SY 40 RT 33 FD 100 LT 33
SX 2 SY 0
RT 90 LT 62 FD 141 RT 62
SX 27 SY 0 LT 68 FD 135 RT 68
SX 52 SY 0 LT 75 FD 128 RT 75
SX 77 SY 0 LT 81 FD 126 RT 81
SX 102 SY 0 LT 88 FD 124 RT 88
SX 127 SY 0 LT 95 FD 124 RT 95
SX 152 SY 0
LT 101 FD 126 RT 101
SX 177 SY 0
LT 108 FD 128 RT 108
SX 202 SY 0
LT 114 FD 135 RT 114
SX 227 SY 0
LT 118 FD 141 RT 118
LT 90
SX 252 SY 0
```

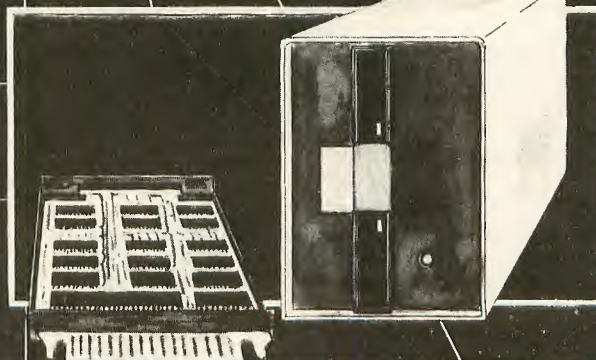
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```
LT 34 FD 150 RT 34
SX 252 SY 32
LT 38 FD 116 RT 38
SX 252 SY 59
LT 42 FD 88 RT 42
SX 252 SY 73
LT 46 FD 74 RT 46
SX 252 SY 88
LT 49 FD 54 RT 49
SX 252 SY 98
LT 51 FD 39 RT 51
SX 252 SY 108
LT 55 FD 28 RT 55
SX 252 SY 115
LT 57 FD 17 RT 57
SX 252 SY 123
LT 59 FD 2 RT 59
SX 45 SY 50
HATCH 1 TREE 23 :0
SX 198 SY 50
TREE 23 :0
SX 150 SY 125 SPHERE 20 :0
```

END

```
TO TREE :N :C
PENCOLOR :C
IF :N>6
(FD :N LT 30
HATCH 1 TREE (3*:N/4) :C
RT 60
HATCH 2 TREE (3*:N/4) :C
HT)
```

END

TO POSR1

```
SHAPE RRRRRRRRRRRRRRRRRRRRRRRRRR-
BBBUFFFFLBBBBBBBBBBBBBLLDFFFFFFF-
FFFFFFLFFFFUBBBBBBBBBBBBBBBBBBLLL-
FFFFFFDFFFFFFRRBBBBBBBBBBBBBUFFFF-
FFFFFFFFRRDFFFFFFFFFFFFLLFFFRFFUB-
BDBBUFFLLDFFFFFFFFFFFFUBBBBBBBB-
BBBBBBBBRRBBBBBBBBBLLLDFFFFFFFR-
RFFFLFFFFFFFFFFLLFFFFFFFFLLFFFF-
FFFLFFFF
```

END

TO POSR2

```
SHAPE RRRRRRRRRRRRRRRRRRRRRRRRRR-
BBBUFFFFLBBBBBBBBBBBBBLLDFFFFFFF-
FFFFFFLFFFFUBBBBBBBBBBBBBBBBBBLLL-
FFFFFFDFFFFFFRRBBBBBBBBBBBBBUFFFF-
FFFFFFFFRRDFFFFFFFFFFFFLLFFUBBD-
BBUFFRRDFFFFFFFFFFFFUBBBBBBBBBBB-
BBBBBBBBBBBBBLLLDFFFFFFFRFFF-
FLLFFFFFFFFLLFFFFFFFFLLFFFFFFFF-
LLFFFF
```

END

TO POSR3

SHAPE RFFFFFFFFRFFFFFFFFFFFFFRB-
 BBUFFFFLBBBBBBBBBBBBBLLDFFFFFFF-
 FFFFFLBBBBBBBBBBBBBRFFFFUBBBBLF-
 FFFFFFFFFFRBBBBBBBBBBBBBLLFFFFFF-
 FFFFFFFFFRBBBBBBRRFFFFFFFFUBBBBBBL-
 LFFFFFFFFRDFFFFFFFFFFFFFLLFFUBBDBB-
 UFFRRDFFFFFFFFFFFFFFFFFUBBBBBBBB-
 BBBBBBBBBBBBBBBBBBLLDFFFFFFF-
 RFFFFLLFFFFFFFFFLLFFFFFFFFFLLFFF-
 FFFFFLLFFF
 END

TO POSR4

SHAPE RFFFFFFFFRFFFFFFFFFFFFFRB-
 BBUFFFFLBBBBBBBBBBBBBLLDFFFFFFF-
 FFFRRFFFFFFFFFFFFFFFFFLLFFFFUBBBLL-
 FFFFFFFFFFLLFFFFFFFFFFFFRRFFFF-
 FDFRRFFFFUBBBBDBBBBUBFFFLDFFF-
 FRBBBBUFFFRDFFFFFFFFFRBBBLLFFU-
 BBDBUBFFRRDBBBBUBFFFLBBBBBB-
 BBLDFFFFFFFFFRFFFFLLFFFFFFFFFLL-
 FFFFFFFFFLFFFLBBBBUFFFRDFFFL-
 LFFF
 END

TO POSR5

SHAPE RFFFFFFFFLFFFFFFFFFFFFFLF-
 FFFUBBBBRRBBBBBBBRRDFFFFFFFFFRBB-
 BUFFFFLBBBBBBBRRFFFFRFFFFFDF-
 FFFFFRRBBBBBBBBBBBUBFFFFFFFFFFFF-
 FFFFFFFFFFLLFFFFRRFFUBBDBBUFFLL-
 DFFFFFFFFFFFFFFFFFUBBBBBBBBBBBBBB-
 BBBBBBBRRBBBBBBBLLDFFFFFFFFRRF-
 FFLFFFFFFFFFLLFFFFFFFFFLLFFFFFFF-
 FLLFFFF
 END

TO POSR6

SHAPE RFFFFFFFFLFFFFRRFFFFFFFFF-
 RBBBUBFFFFLBBBBBBBBBLLBBBBLDFFFF-
 FFFFFRRFFFFFFFFFFFFFFFFFLLFFFFUBBB-
 LLFFFFFFFFFFFFFFFFFLLFFFFFFFFRRFF-
 FFDFFFFFFFFRBBBBBBLBBBBBUBFFFF-
 RFFFFFDFFFFFFFFFFFFFFFFFLLFFUBBDBB-
 FFRRDFFFFFFFFFFFFFFFFFUBBBBBBBBBBBB-
 BBBBBBBBBBBLDFFFFFFFFFRFFFFLLFF-
 FFFFFLLFFFFFFFFFLLFFFFFFFFFLLFFF-
 F
 END

TO POSR7

SHAPE RFFFFFFFFRFFFFFFFFFFFFFRB-
 BBUFFFFLBBBBBBBBBBBBBLLDFFFFRFF-
 FFFFFLLFFFFUBBBBLLFFFFFFFFFLLFFF-
 RFFFFFFFFDFFFFFFFFRRBBBBBBBBBBBUBF-

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```

FFFFFFFFFFFFLDFFFFFFFFRRFFFFLLFF-
UBBDBBUFFRRDFFFFFFFFFFFFFUBBBBBB-
BBBBBBBBBLLBBBBBBBLDFFFFFFFFFR-
RFFFFLLFFFFFFFFLLFFFFFFFFLLFFFF-
FFFFLLFFFF
END

```

TO RIGHTY :B :O

HT SH 90 PU

SX 100 SY 50

POSR1 WHILE MAIL 0=0 ()

ST

FD 5

REPEAT 2(MOVER)

BK 5

REPEAT 2(MOVER)

FD 10

REPEAT 2(MOVER)

BK 5

REPEAT 2(MOVER)

BK 5

REPEAT 2(MOVER)

FD 5

REPEAT 2(MOVER) SEND 0 1

STAB

END

TO MOVER

POSR1 BK 2 POSR5 FD 2 POSR2

FD 6 POSR7 POSR3 BK 5 POSR4

FD 6 POSR6 POSR3 BK 3 POSR2

BK 4 POSR1

END

TO STAB

POSR3

FD 10

BK 10 POSR1

END

TO FIGHT :O

SLOW 20 HATCH 1 RIGHTY

LEFTY :O

END

TO LEFTY :O

HT SH 270 PU

SX 140 SY 50

POSL1 SEND 1 1

ST

BK 5

REPEAT 2(MOVEL)

FD 5

REPEAT 2(MOVEL)

BK 10

REPEAT 2(MOVEL)

FD 5

REPEAT 2(MOVEL)

FD 5

REPEAT 2(MOVEL)

BK 5 IF MAIL 1=1 (UGH :O STOP)

REPEAT 2(MOVEL)

UGH :O

END

TO MOVEL

POSL1 FD 14 POSL6 BK 18 POSL2

FD 6 POSL7 BK 8 POSL1 FD 5

POSL3 FD 6 POSL5 BK 12 POSL4

FD 7 POSL2

END

TO UGH :O

POSL6

FD 6

POSLC

SEND 1 1

END

TO POSLC

POSLC1

POSLC2

POSLC3

POSLF RT 45 RT 45

END

TO POSLC1

```

SHAPE LLFFFFFFFFFFFFLFFFFFFFFFLB-
BBBUFFFFRBBBBBBBBBRBBBBRDFFFFLFF-
FFFFFFFFRRFFFFFUBBBBBRRFFFFFFFFRRFF-
FLFFFFFFFFDFFFFFFFFRBBBBBBBBBBBBBULB-
BDBBBBUFFLLDBBUFFDFFFFFFFFFFFFFFFF-
FFFUBBBBBBBBBBBBBBBBBRRFFFFFFFFRRFF-
FFFFFFFFFRDFFFFRRFFFFLBBBBUFFFFR-
BBBBRRFFFFRRDFFFFFFFFRRFFFFLLFF-
FFFFFFFFLLFFFFFFFFLLFFFFFFFFLLFFF-
F

```

END

TO POSLC2

```

SHAPE LLFFFFFFFFFFFFLFFFFFFFFFLB-
BBBUFFFFRBBBBBBBBBRBBBBRDFFFFLFF-
FFFFFFFFRRFFFFFUBBBBBRRFFFFFFFFRRFF-
FLFFFFFFFFDFFFFFFFFLFFFFLFFFFFFFFFL-
UFFFFFFFFFFFFDFFFFUBBRRDBBUFFDFFF-
FFFFFFFFFFFFFUBBBBBBBBBBBBBBBBBRR-
RRFFFFFFFFRRFFFFFFFFRRFFFFDFFF-
FRRFFFFLBBBBUFFFFRBBBBRRFFFFRRD-
FFFFFFFFRRFFFFLLFFFFFFFFLLFFFFFF-
FFLLFFFFFFFFLLFFFF

```

END

TO POSLC3

```

SHAPE LLFFFFFFFFFFFFLFFFFFFFFFLB-
BBBUFFFFRBBBBBBBBBRBBBBRDFFFFLFF-

```

♦ to page 90

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```

FFFFFFFFRRFFFFUUFFDFLLFFUBBDBBUFF-
RRDFFFFFFFFFFFFFFFFFUBBBBBBBBBBBB-
BBBBBBBBBBBBBBRRFFFFFFFFFFFFFLFF-
FFFFDFFFFFFFFLLFFFFLLFFFFFFFFFUBB-
BBBBLLFFFFDFFFFRRFFFFFLBBBBUUFF-
FRBBBBRRFFFFRRDFFFFFFFFFFFFRFFFF-
FFFFFFFFLLFFFFFFFFFLFFFFFFFFLLF-
FFF
END
    
```

TO POSLF

```

SHAPE LLFFFFFFFFFFFFFFFFFFFFRR-
FFFUBBBBLLBBBBBBBBBBBBBRRDFFFFLF-
FFFFFFFFRRFFFFUUFFDFLLFFUBBDBBUF-
FRDFFFFFFFFFFFFFFFFFUBBBBBBBBBBB-
BBBBBBBBBBBBBBRRFFFFFFFFFFFFFLF-
FFFFDFFFFFFFFLLFFFFLLFFFFRBBBBU-
FFFLBBBBRRBBBBBDBBBLLFFFFLBBBBU-
FFFFRBBBBRRFFFFRRDFFFFFFFFFFFFR-
FLLFFFFFFFFLLFFFFFFFFFLFFFFFFFF-
LLFFFF
END
    
```

TO POSL1

```

SHAPE LLFFFFFFFFFFFFFFFFFFFFRF-
FFUBBBBLLBBBBBBBBBBBBBLLDFFFFFFF-
FFFFFLBBBBUFFFFRBBBBBBBBBBBBBLL-
FFFFFFFFDFFFFFFFFLBBBBBBBBBBBBBU-
FFFFFFFFLLDFFFFFFFFRRFFFFLLFFUB-
BDBBUFFRRDFFFFFFFFFFFFFFFFFUBBB-
BBBBBBRRFFFFFFFFFFFFLDDFFFFRRF-
FLLFFFFFFFFFLFFFFFFFFFLFFFFFFF-
FLLFFFF
END
    
```

TO POSL2

```

SHAPE LLFFFFFFFFFFFFFFFFFFFFRF-
FFUBBBBLLBBBBBBBBBBBBBLLDFFFFFFF-
FFFFFLBBBBUFFFFRBBBBBBBBBBBBBLL-
FFFFFFFFDFFFFFFFFLBBBBBBBBBBBBBU-
FFFFFFFFLLDFFFFFFFFRRFFUUBB-
BUFFLLDFFFFFFFFFFFFFFFFFUBBBBBBB-
BBBBBBBBBBBBBBRRDFFFFFFFFFFFFR-
FLLFFFFFFFFFLFFFFFFFFFLFFFFFFF-
LLFFFF
END
    
```

TO POSL3

```

SHAPE LLFFFFFFFFRRFFFFFFFFFFFFR-
BBBBBBBBBBBBBLLFFFFUBBBRRFFFFFFFF-
FFFFLBBBBBBBBBBBBBRRDBBBBBBBBBB-
LFFFFUBBBRRFFFFFFFFFFFFFFFFFFFFD-
FFFFFLBBBBBLLFFFFFFFFFUBBBBBBRR-
FFFFFLDFFFFFFFFRRFFUUBBDBBU-
FLLDFFFFFFFFFFFFFFFFFUBBBBBBBBB-
BBBBBBBBBBBBBBBBBBRRDFFFFFFFFRR-
    
```



```

FFFFLLFFFFFFFFLLFFFFFFFFLLFFFFF--
FFLLFFFF
END

```

TO POSL4

```

SHAPE LLFFFFFFFFRRFFFFFFFFFFFFLLF--
FFFFFFFFFFFFRRFFFFUBBBBBRRFFFFFFFF--
FFFFRRFFFFFFFFFFFFRDFFFFFFFFFFFF--
LBBBBUFFFFRBBBBBBBBBBBBBLLLFFFFF--
FDFRRBBBBUFFFFDFFFFRBBBBUFFFFL--
BBBBLLDFFFFLLFFFFFFFFFLBBBBRRFFU--
BBDBUFFFFRDFFFFUBBBBBBBRRFFFFFFFF--
FLLDFFFFFFFFLLFFFFRRFFFFFFFFRR--
FFFFFFFFRRFFFFRBBBBUFFFFLDFFFFR--
RFFFF
END

```

TO POSL5

```

SHAPE LLFFFFFFFFRRFFFFFFFFFFFFRRF--
FFFUBBBBLBBBBBBBBBLDFFFFFFFFLBB--
BUFFFFRBBBBBBBBBLLFFFFLFFFFFDF--
FFFFLLBBBBBBBBBBBUFFFFFFFFFFF--
DFFFFFFFFRRFFFFLLFFUBBDBUFFFFR--
DFFFFFFFFFFFFFFFFUBBBBBBBBBBBBBB--
BBBBBBRRFFFFFFFFLLDFFFFFFFFRRF--
FFLLFFFFFFFFLLFFFFFFFFLLFFFFF--
FLLFFFF
END

```

TO POSL6

```

SHAPE LLFFFFFFFFRRFFFFFFFFFFFFLLF--
FFFFFFFFFFFFRRFFFFUBBBBBRRFFFFFFFF--
FFFFRRFFFFFFFFFFFFLDBBBBLLBBBBBB--
BBLFFFFUBBBBRFFFFFFFFRRFFFFLFFF--
FFDFFFFFFFFLBBBBBBRBBBBBUFFFFF--
LFFFFFFFFDFFFFFFFFFFFFLLFFUBBDBU--
FFRRDFFFFFFFFFFFFUBBBBBBBBBBBBBB--
BBBBBBBBBBBRDFFFFFFFFRRFFFFLLFF--
FFFFFLLFFFFFFFFLLFFFFFFFFLLFFF--
F
END

```

TO POSL7

```

SHAPE LLFFFFFFFFRRFFFLFFFFFFFFFR--
RFFFFUBBBBRFFFFFFFFRRFFFFRDFFF--
FFFFFFFFFLBBBBUFFFFRBBBBBBBBBBB--
BLLLFFFFFFFFDFFFFFLBBBBBBBBBBBBB--
UFFFFFFFFFFFFRDFFFFFFFFLLFFFFRR--
FFUBBDBUFFFFLDFFFFFFFFFFFFUBBB--
BBBBBBBBBBBRBBBBBBBRDFFFFFFFF--
RRFFFFLLFFFFFFFFLLFFFFFFFFLLFF--
FFFFFLLFFFF
END

```

TO SPHERE :R :C

PENCOLOR :C SH 270

REPEAT 180

(FD :R BK :R RT 1)

END

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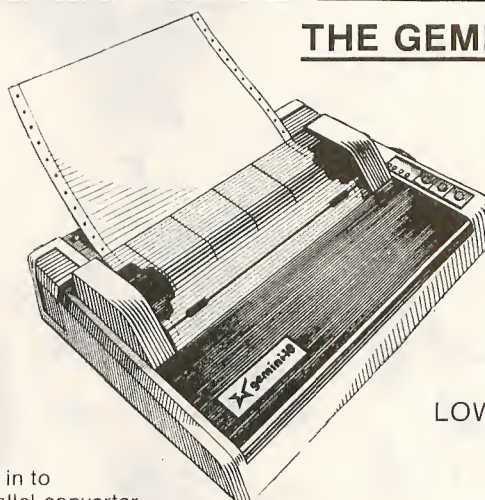
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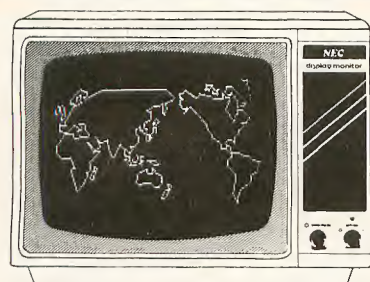
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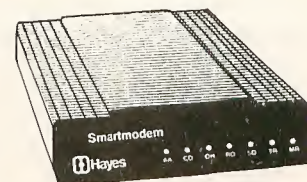
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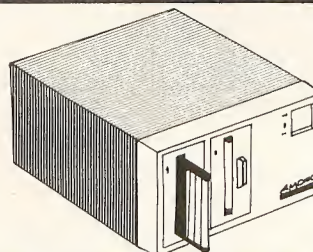
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Graphics?



Part I

Here's the first of a three-part series introducing the Color Computer programmer to graphics techniques.

YOU'VE PROBABLY HEARD generous praise about the powerful, flexible machine the Color Computer is supposed to be. And perhaps when you first unpacked your new toy you were content for awhile to plunk down 30 bucks each for prepackaged program tapes and ROMpaks.

But now you want more out of your machine, more control, more creativity, more fun. You want to learn how to make it do what *you* want it to do, to fashion your own graphics in order to commit to the CRT the particular nooks of your mind. You want to see for your self where all this power lies.

This article is the first in a series designed to introduce you to the fundamentals of computer graphics. The assumption here is that you know very little about controlling your computer — perhaps nothing at all. You're not going to be expected even to know Basic, though some knowledge won't hurt.

Take this magazine to your computer and turn the machine on. There's no point in trying to learn about the Color Computer *without* testing things out, so use the computer liberally while you read. We'll try to give you plenty to do.

For starters, type this in:

*by Scott L. Bain and
Andrea R. Chartier*

```
NEW <ENTER>
10 PCLEAR 4 <ENTER>
20 PMODE 4,1:PCLS <ENTER>
30 SCREEN 1,1 <ENTER>
40 X=RND(256):Y=RND(192)<ENTER>
50 LINE -(X,Y),PSET <ENTER>
60 GOTO 40 <ENTER>
RUN <ENTER>
```

(<ENTER> means "Press the Enter key," and from now on we'll leave it out, assuming that you know to use it at the end of each line.)

When you're tired of watching the mess this program produces, press the Break key. What you have just seen is a randomized demonstration of the Line command in what is called an "endless loop." That means that unless you press Break, the program will continue forever.

Now type:

```
DEL 40-60
70 GOTO 70
RUN
```

What you are looking at now is a blank graphics screen, kind of like a chalkboard before anything has been written on it. You'll notice that it is not like the normal "text" screen — pressing a key causes no letter to appear.

Primarily all you do in graphics programming is tell the computer what to draw, where to draw it, what resolution (detail) to use, and what color to make it.

The Pixel

The basic unit on the graphics screen is the pixel, or "picture element." Each pixel occupies a specific location on the screen and may be "on" or "off" to a particular color. Press Break and type in:

```
40 PSET (128,96,5)
RUN
```

The dot you now see in the center of the screen is a single, high-resolution pixel, turned on to color 5 (buff). Everything you create on the graphics screen is made up of these pixels, so the first thing

♦ *next page*



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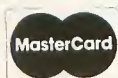
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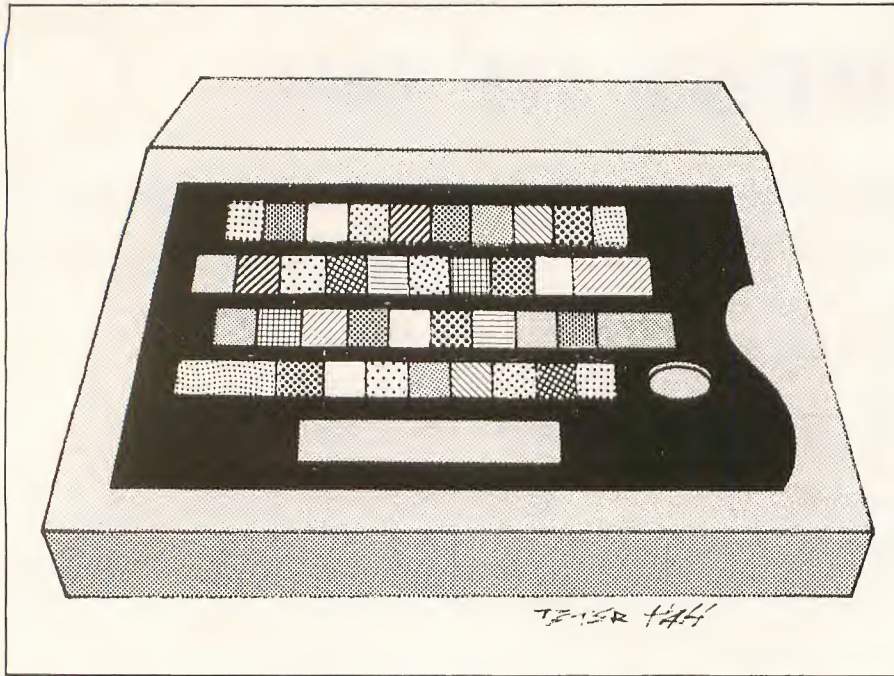


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This is low resolution, with its even larger pixels. What we've shown you here so far are the Color Computer's three two-color modes, PMODES 4, 2, and 0. PMODE 3 is the four-color, medium resolution mode, and PMODE 1 is the four-color, low resolution mode. There is, alas, no natural four-color mode for high resolution.

If you're totally confused, and that would be understandable, Table 1 presents a summary.

We've added something new called the PCLEAR number. List the program and you'll find that the first command is PCLEAR. This is used to reserve enough of your computer's memory for graphics, and should be the very first command in your program. As you may have guessed, the number that follows the PCLEAR command varies with the PMODE you're using, and that's why it is on the chart.

The Screen Command

Now you know how to set the resolution and number of colors on your computer. But how, you ask, to decide which colors are to be used? The answer is the SCREEN *m,cs* command. The *m* means mode and is always set to 1 for graphics. In fact, it is the very thing that tells the computer to display the graphics screen.

The *cs* is the color set parameter, and must be either 0 or 1, with the result shown in Table 2.

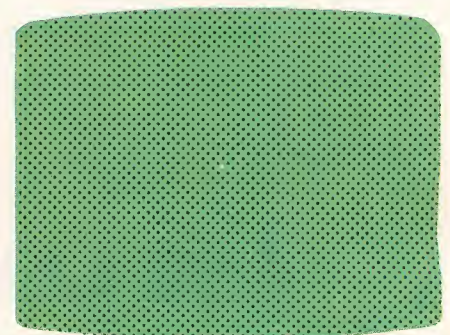
Using the two charts in combination, you can see that PMODE 3,1 followed by SCREEN 1,0 will set up the screen for medium resolution, using the colors green, yellow, blue, and red.

Now test yourself: what would PMODE 1,1 followed by SCREEN 1,1 set the screen up for?

Answer: Four-color low resolution using buff, cyan, magenta and orange.

The Color Command

This is a command that we have not been using in our program so far, be-



A Pixel

to learn is how to control them one at a time.

The command PSET(*x,y,c*) tells the computer to "turn on (set) the pixel at location *x, y* to color number *c*." The *x* and *y* variables are coordinates, *x* being the distance, in pixels, from the left-most edge of the screen, and *y* being the distance from the top (0,0 is the upper left-most corner, therefore, and 255,191 is the lower right-most corner.) *X* can never be larger than 255, and *y* can never be larger than 191.

The command PRESET(*x,y*) tells the computer to "turn off (reset) the pixel at *x,y*." You don't need to specify the color here, because "off" for a pixel is always the background color, which is now the color 0 (black).

Try a little experimentation on your own and type in the following program, replacing the *x* and *y* in each case with numbers of your choosing:

```
<BREAK>
40 PSET(x,y,5)
50 PSET(x,y,5)
60 PSET(x,y,5)
RUN
```

Try this a few times using different numbers and see what you get. When you are done, list the program you have and look it over. Don't expect to understand everything, but make some guesses and see if you're right later on. Listing is done by typing the word LIST and Enter-ing.

The PMODE Command

Now that you have learned how to turn pixels on and off, it's time to play with the resolution, which is really just a fancy word meaning pixel size. The PMODE command is used to determine two things — how big the pixels are (one of three sizes) and how many colors will be available (two or four). It's also used to determine something called the page, but that's a fairly advanced concept that we don't need to deal with in most applications. For now, any time a command calls for a page number, use 1.

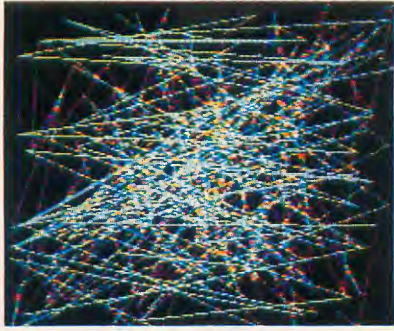
Our current program is set up for high resolution (PMODE 4 — the ,1 sets the page), which allows for only two colors (5 — buff and 0 — black) and uses very small pixels. To get a look at medium resolution, press Break if the program is running, then type:

```
20 PMODE 2,1:PCLS
RUN
```

(PCLS tells the computer to clear the graphics screen to the background color, like using a rather large eraser on our chalkboard.

The dots are a little larger now, but everything else is pretty much the same. In fact, the only thing we changed in Line 20 was the numeral 4, which we made a 2. Now Break and type:

```
20 PMODE 0,1:PCLS
RUN
```

ground color. In our program this would be 0 (black) because we have chosen the two colors 0 (black) and 5 (buff) and have not specified which of them is to be the foreground and which the background.

Try this:

```
NEW
10 PCLEAR 2
20 PMODE 1,1
30 SCREEN 1,0
40 COLOR 2,1
50 PCLS
60 PSET(128,96,2)
70 GOTO 70
RUN
```

cause it is not usually used in two-color modes, and is not really necessary at all for the PSET method of controlling pixels. But, as you will learn in Part 2 of this series, there are other graphics commands, like Line and Circle, that use what are called the foreground and background colors. If you do not set them using the COLOR f,b command, the foreground will always be the highest numbered color available in the color set you've chosen, and the background will always be the lowest.

For example, we have said that the preset (PRESET) command uses the back-

Study this example carefully. What would have happened if we had left out the Color command in step 40? As we've stated, if you do not specify, the foreground color will be the highest numbered color available in the set, which in this case would be 4, or red. But since the only drawing command we use is PSET, and it does not use the default foreground color, the program would work just the same without the Color command.

In Part 2 we'll learn about some commands that are less friendly at first, but quite a bit more powerful. ■ ■ ■

Table 1. Summary Table

PMODE	RES	Number of Colors	PCLEAR
0	low	2	1
1	low	4	2
2	med	2	2
3	med	4	4
4	high	2	4

Table 2. Color Set Parameter Results

PMODE TYPE	SCREEN cs	COLORS
2-color	0	black(0) green(1)
2-color	1	black(0) buff(5)
4-color	0	green(1) yellow(2) blue(3) red(4)
4-color	1	buff(5) cyan(6) magenta(7) orange(8)

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TLC

Here's a few basic rules to help you keep your Color Computer working well.



ALTHOUGH YOUR Color Computer, peripherals and software do not need elaborate maintenance, you *can* lessen the frequency of your down time. Most repairs require you to return your unit to the dealer; to avoid this, refer to these outlines when planning, installing, or operating your Color Computer, peripherals and software.

To prevent inadvertent damage to your computer, follow the operator's manual to the letter. In addition to the specific hardware recommendations, here are some maintenance suggestions.

Cleaning

Keep a dust cover on your computer when you are not using it. This helps avoid spilling anything on the keyboard. If you do spill, bring the unit to a service center for a cleaning before damage occurs. The keyboard is the weakling of your system, so be very careful with it.

Keep disks and cassettes clean. Do not touch the exposed recording surface. Small scratches, dust, food, or tobacco particles can make them unusable.

Put the disks in their envelopes as soon as you remove them from the drive, and store them away from the heat and magnetic field sources. Telephones, dictation equipment, and electronic calculators are a good source of magnetism. The same goes for your cassettes.

Make back-ups regularly; and keep a

by Isaac Szlechter

copy of any disk storing permanent data, master files, operating systems or programs.

Keep disk drives clean. Use a head cleaning kit about once a week, or for every 15 hours of use. Avoid sudden jolts to the drive. A bang can misalign the heads.

Do's and Don'ts

Do not oil your printer; it does not need oil. Most of the bearings and moving parts are self-lubricating. Vacuum your printer often and wipe its surface with a light all-purpose cleaner.

If you have a daisy wheel printer, clean clogged recessed type areas with a Printwheel Cleaning Kit.

To prolong your Color Computer's life, as well as your peripherals and software, follow these environmental hints:

Keep the air around your system clean and keep your equipment away from smoke, dust, and open windows. If you have air conditioners, change the air filter often.

To avoid dust, dirt and surface scratches on your hardware, cover them with vinyl dust covers.

Avoid voltage variations — "ghost problems" — by using a power line not

shared by any other appliance. If the problem persists, install a power surge protector or a power line filter.

Place a protective anti-static mat under your system or use anti-static spray on your carpet to prevent user static electricity. Static electricity often causes errors in your computer and can crash your system.

Operate your computer at a low room temperature; too cold is better than too hot.

Travel Tips

To avoid damaging your system when transporting, follow these packing procedures:

When traveling short distances, carefully disconnect all cables. Coil the cables to protect the connections, and tape coiled cables to the system unit, so the unit may be carried safely. Move each unit separately.

For long distance traveling, use all packing materials (corner braces, foam cushions). Pack the hardware in original cartons if available. If using different cartons, cushion well to avoid damage.

You may find some of these suggestions, hints and procedures new and some of them not so new. To avoid breakdowns and to assure your equipment a long life, follow all these directions, like your operator's manual, "to the letter" all the time. ■ ■ ■

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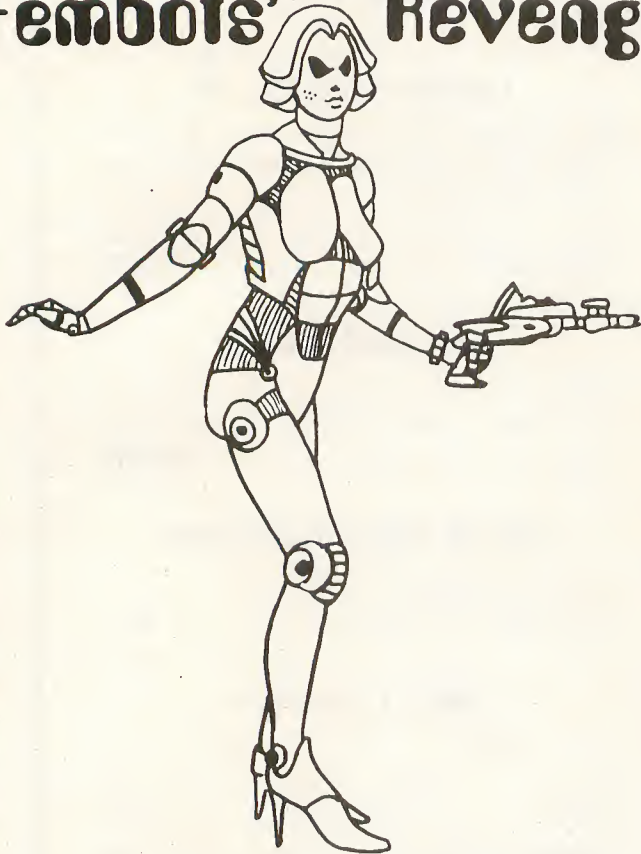
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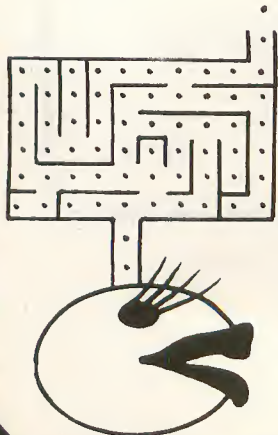


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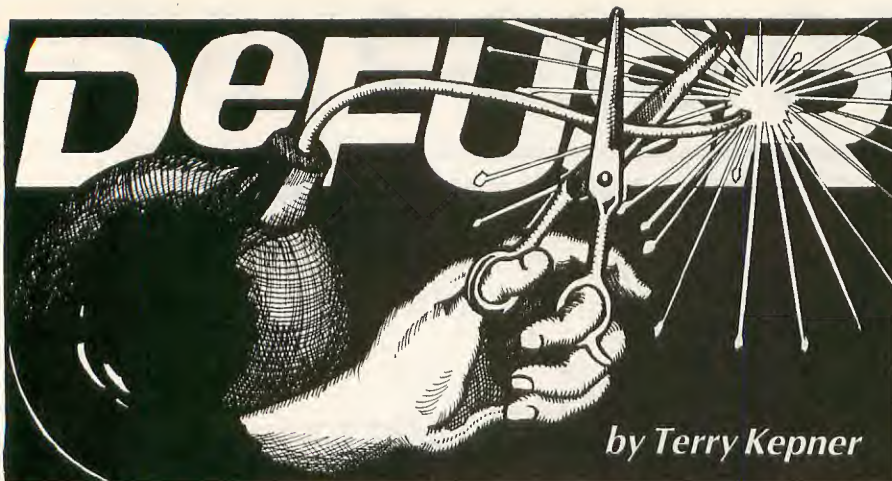


Illustration by Rod McCormick

I'm a computer science major and want to get a headstart on learning languages like Pascal and Forth. I would appreciate any advice you can give me.

W.T., Staten Island, NY

There's a variety of languages for the Color Computer: Assembly, Pascal, Forth, Logo, and Pilot. Assembly language, a low level language where the programmer does all the work, is the Color Computer's language. It uses mnemonics for machine language computer instructions, and is quite specific to the 6809 chip. Learning assembly language would be a good start if you intend to do machine language programming on a large scale. An advantage to assembly language is that other assembly languages are similar in construction; once you know 6809 assembly language, it's not hard to learn 8080, Z-80, or 6502 assembly language.

Forth is the next step up in complexity. It combines the ease of high level programming with the nittygritty of machine code. It's a strange and complex language. You can add to the complexity of the language by inventing and defining new words in it. The July 1983 issue of **The Color Computer Magazine** has a review that explains Forth and describes the Color Computer versions available.

Pascal is a high level language, primarily designed as an educational tool, to introduce students to the concepts of structured programming. Pascal is so structured it almost requires you to write your program before you enter it into the computer. Its strong points are flexible data type definitions and I/O routines.

Logo is a teaching language, primarily for children. It lets them create and define their own words in Logo, similar to Forth, using words previously defined. Logo has an interactive and programming mode.

Pilot is a teacher's language. Its primary purpose is quick and easy generation and application of multiple-choice type tests. If you want to write programs to test people on a computer, Pilot is a good choice.

For some reason, colleges seem to think that Pascal is a superior language, and many insist on students learning it. In fact, the National Board of Colleges has decided to make Pascal a requirement for incoming computer science major freshmen. Personally, I think Forth would be a better choice.

To answer your question, get Pascal first, then try Forth. When they become available, get APL, Fortran, Cobol, and Lisp.

I bought some 64K chips and upgraded my Color Computer to 64K. It checks out fine, but the limited integer capability won't display the total free memory. I heard someone can rectify this problem. Can you help?

Also, I now have to stare at a RAM ID button that says 16K. Can I get one that says 64K?

B.G., Alameda, CA

Spectrum Associates (93-15 86th Dr., Woodhaven, NY 11421) sells a routine for \$9.95 that will display the right memory size. If that's too expensive, then you'll need a short machine language program that replaces the current free-memory routine. If you examine Jake's memory map series, you'll find the free-memory routine. You can write your own routine using single precision by using the integer routine as a programming guideline.

About the ID button: I don't know of a supplier for buttons that say 64K.

I have a TRS-80 Color Computer, one disk drive, and an Olympia electronic typewriter with RS-232 interface.

This set-up worked fine until I purchased **Scriptsit**. Now my typewriter doesn't return when it reaches the right hand margin, and it regularly drops data from the print-out (it appears the information is coming too fast for my printer).

I have a program that I put in memory when the computer is first turned on that lets me set the margin and return to whatever I want (60 columns for an 8½ by 11 inch letter). Unfortunately, **Scriptsit** ignores this program, and my printer ignores **Scriptsit**'s margins. Finally, the loss of characters during operation makes this program worthless to me.

I've been told that I need a Basic word processor. Is this correct? Will Telewriter 64 work?

R.W., Portland, TX

You're right, the problem can be corrected by using a Basic word processor. The difficulty with **Scriptsit** is that it is using different codes than those expected by your printer. If you knew where these codes were stored in **Scriptsit**, you could change them to match your printer. The data loss problem is also **Scriptsit**'s fault. For some reason, **Scriptsit** doesn't send data at precisely 600 baud. Instead, it varies above and below the correct value. Your copy appears to be set too high. When **Scriptsit** sends data to your printer, the printer stores the characters in a printer buffer as it prints them out. If this buffer is overfilled while printing, the printer wipes the buffer clean and starts refilling it. Hence, lost characters. Also, **Scriptsit** may not be aware that the printer is "busy," and will not pause while the printer catches up. This could be due to the hardware connections omitting this signal, or because **Scriptsit**'s software doesn't handle it properly. Basic is apparently slow enough to prevent this, but **Scriptsit** (being slightly faster) causes problems.

To use your machine language program, you need a Basic word processor. **Telewriter 64**, **Super Color Writer**, and half a dozen other programs are available (see the March and April 1983 issues for a comparison of the different word processors).

I have a tape-based system. If I'm not sure where a program starts and try to CLOAD, I get an I/O error. I have to repeat this until I finally get to the start of my program. Is there a simpler way?

I've read about excessive heat from the Color Computer, and have

even seen ads for cooling fans. What gives? Also, I'd like to purchase *Color Computer Assembly Language Programming* by William Barden Jr., but none of the Radio Shack Computer Centers are able to order it. What do you suggest?

M.M., Mountlake Terrace, WA

Yes, there is a simpler way. The Color Computer is designed with a Cue/Review feature. Unplug the black plug from the earphone jack, press down the Play button, and then press the Fast Forward (FF) button. You'll be able to hear the programs on the tape pass by as the tape is fast forwarded. When you reach the gap between two programs, release the FF button, press Stop, and plug the black cable back into the earphone jack. Now you can CLOAD without getting an I/O error.

If you pass the beginning of the program with FF, use the Rewind button to back up, still listening to the tape. This system is awkward since you have to unplug and replug your earphone plug, but it's more efficient than the method you use.

The 6809E CPU and the SAM (Sequential Address Multiplexer) chips get quite warm when you use the Color Computer for extended periods of time. The metal RFI shield covering the "brain" of the computer cuts down on natural convection and heat dissipation. In some computers this is a severe problem, causing the computer to go "crazy." The solution is to increase the air flow around these two critical chips. The simplest, but most expensive solution, is to buy a cooling fan. Other solutions to increase circulation involve voiding your Radio Shack warranty. The first is to open your computer and remove the RFI shield. This violates federal law, and will annoy your neighbors with the RFI now released by your computer. This method is *not* recommended. The last method is to open the computer, open the RFI shield, and place heatsinks (using a special thermal glue) on the two chips. The added metal and surface areas of the heatsinks let the chips operate at cooler temperatures. Now replace the RFI shield and the computer's cover. You might want to use one of these solutions even if your computer doesn't seem to get overheated; the cooler your chips are, the longer they'll last.

If you want that book, you'll have to wait a little while. It's currently bogged down in production at Radio Shack. When it's available, you'll be able to get it from any Radio Shack store. ■■■

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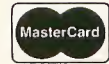
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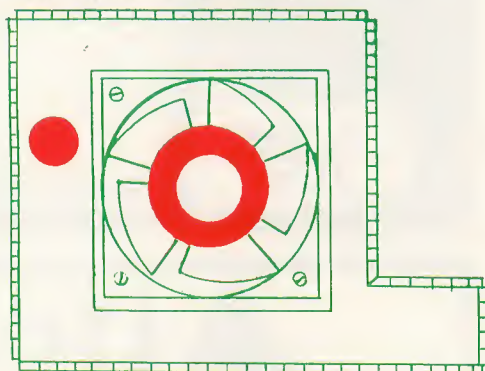
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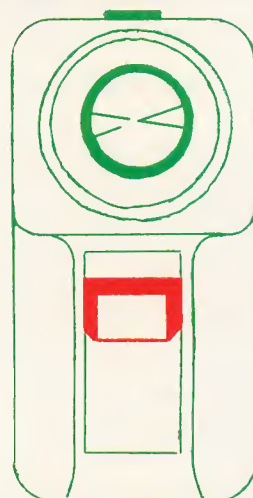
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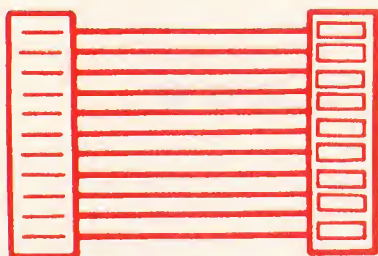
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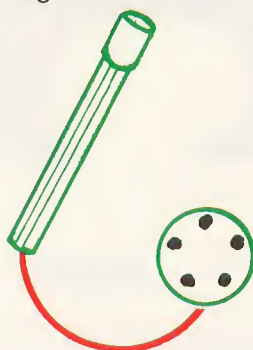
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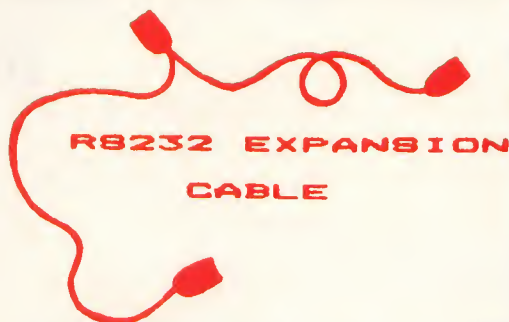
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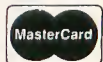


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Cryptography

Want to send a secret message to your boss, your compatriots back home, your beloved? This program will make it easy to do.

by Robert L. Garrett

YOUR COLOR COMPUTER can be a powerful ally, coding or decoding secret messages for you automatically. A French nobleman, Blaise de Vigenère, created a polyalphabetic cipher using more than one cipher alphabet to encrypt a given message. De Vigenère's cipher sabotages the method by which cryptographers conventionally broke secret codes in the past.

For example, if the letter E is coded to be the letter X, then X will show up for the letter E everywhere in the simpler, earlier-method secret message. Cryptographers count the number of X's in the simpler code and conclude that it represents an E, because E is the most frequently used letter. T is the next most frequently used letter, followed by A, O, N, I, R, S, etc. By merely taking a frequency count of the letters, and making substitutions, cryptographers could easily break a code.

Cryptic Cryptography

In de Vigenère's code, however, the letter E is represented differently everywhere in the secret message. Look at the Table to see what de Vigenère did; he made a 26 by 26 matrix of alphabetic letters. When a secret message is to be sent, the two communicating parties agree beforehand on a keyword. The sender must write the keyword repeatedly above the "clear letters," or plaintext.

CAPITALS REPRESENTING KEY LETTERS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
B	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a
C	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b
D	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c
E	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d
F	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e
G	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f
H	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g
I	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h
J	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i
K	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j
L	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k
M	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l
N	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m
O	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n
P	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
Q	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
R	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
S	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
T	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s
U	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t
V	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
W	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v
X	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
Y	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
Z	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y

Table. De Vigenère's Polyalphabetic Cipher Table

For example, the keyword "FOX-TROT" will be used to encode the message "The Color Computer Is Great." The encoder would write:

Keywords: FOXTROTFOXTROTFOXTROTFO

Plaintext: THECOLORCOMPUTERISGREAT

Now look at the Table and find the F in the key letters column, and the T in the clear letters row. Look down the column and row to find the first cipher letter, Y. The complete cipher text, or encoded message, is: YVBVFZHWQLFGIMJFLXFXFH using FOXTROT as the keyword.

```
IF YOU WANT TO DECODE INPUT 2
1 OR 2?
KEYWORDS???
PLAINTEXT??
?

IF YOU WANT TO ENCODE INPUT 1
IF YOU WANT TO DECODE INPUT 2
1 OR 2? 1
KEYWORDS??? THE COLOR COMPUTER
PLAINTEXT??? IS A DELIGHT TO ME
BZWECPZZXJHFIIHOV

IF YOU WANT TO ENCODE INPUT 1
IF YOU WANT TO DECODE INPUT 2
1 OR 2?
```

Encryption Program

Try this message with the Color Computer program I have written, and see how easy it is to encode or decode a message provided you know the keyword. The computer can do the ciphering more quickly than you can yourself, but be sure not to leave any spaces between words or the code will not come out correctly. De Vigenère claimed this code was unbreakable, and so it was found to be for many years. However, it can now be broken by an expert, but takes quite a bit of time.

The program, once entered into the computer, works as follows: The program will display: CRYPTOGRAPHY, WAIT 25 SECONDS FOR DATA TO FILL ARRAY. After 25 seconds, the 26 by 26 array is filled with the correct alphabetic characters. The computer now displays: TO ENCODE TYPE 1 TO DECODE TYPE 2. To encode means to encrypt, or make into a secret message. To decode means to unscramble the secret message into a readable message. After pressing 1 for encode, the computer asks for the keywords, and then for the plain text, or message to be coded.

If you push 2 for decode, the program asks for the cipher text, or scrambled message. Remember, the code you use must be based on de Vigenère's code. The program then asks for the keyword, and the message is unscrambled.

I used an Extended Basic computer to write this program, but Extended Basic is not required if you remove statements 6 and 7 from the program. ■ ■ ■

Program Listing. Cryptography Program

```
3 CLEAR 1000 : CLS
4 DATA A,B,C,D,E,F,G,H,I,J,K,L,M
,N,O,P,Q,R,S,T,U,V,W,X,Y,Z
5 DIM A$(26,26)
6 PRINT@64,STRING$(32,"*")
7 PRINT@384,STRING$(32,"*")
8 PRINT@202,"CRYPTOGRAPHY"
9 PRINT@296,"WAIT 12 SECONDS":PR
INT@325,"FOR DATA TO FILL ARRAY"
10 FOR Z=1 TO 26
20 READ A$(Z,1)
30 A$(Z,0)="*" : NEXT Z
40 FOR Y=2 TO 26
50 FOR X=2 TO 26
60 A$(X-1,Y)=A$(X,Y-1)
70 NEXT X
80 A$(26,Y)=A$(1,Y-1) : A$(0,Y)=
"*" : NEXT Y
90 A$(0,0)="*" : A$(0,1)="*"
100 CLS : PRINT : PRINT
110 PRINT " TO ENCODE TYPE 1"
120 PRINT " TO DECODE TYPE 2"
130 INPUT " 1 OR 2";N : IF
N<>1 AND N<>2 THEN 130
140 IF N=2 THEN 300
150 INPUT "KEYWORDS ";K1$
160 INPUT "PLAIN TEXT ";P$
170 B=LEN(P$) : K$=""
180 FOR Z=1 TO B/LEN(K1$)+1
190 K$=K$+K1$ : NEXT Z
200 FOR Z=1 TO B : X1=0 : Y1=0
210 FOR X=1 TO 26
220 IF A$(X,1)=MID$(P$,Z,1) THEN
Y1=X
230 IF A$(X,1)=MID$(K$,Z,1) THEN
X1=X
240 NEXT X
250 PRINT A$(X1,Y1);
260 NEXT Z : GO TO 430
300 INPUT "CIPHER TEXT";C1$
310 INPUT "KEY WORDS ";K1$
320 F=LEN(C1$)
330 FOR Z=1 TO F/LEN(K1$)+1
340 K$=K$+K1$ : NEXT Z
350 FOR Z=1 TO F : YF=0 : X1=0
360 FOR X=1 TO 26
370 IF A$(X,1)=MID$(K$,Z,1) THEN
X1=X
380 NEXT X
390 FOR Y=1 TO 26
400 IF A$(X1,Y)=MID$(C1$,Z,1) TH
EN YF=Y
410 NEXT Y
420 PRINT A$(YF,1); : NEXT Z
430 PRINT : PRINT : GO TO 110
```




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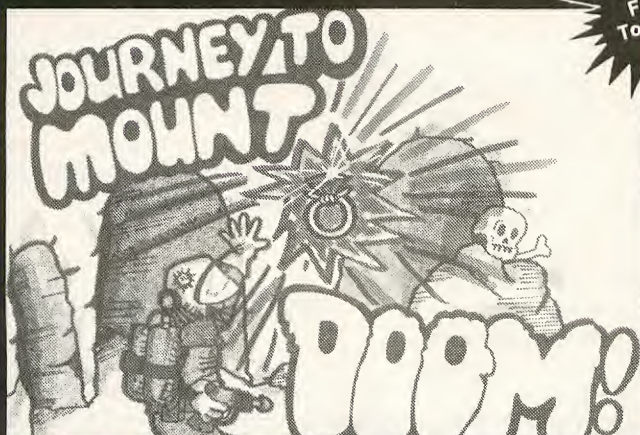
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FLEX AND OS/9:

An Inside View

FLEX and OS/9 are two of the hottest products on the market! Here's a detailed look at both of them.

THIS DISCUSSION compares FLEX and OS/9, the most popular non-Motorola true disk operating systems for the Motorola 6809 microprocessor. Both are available for the 6809E-based Radio Shack Color Computer and Tandy TDP-100. Many readers of **The Color Computer Magazine** are unaware of the features of these operating systems.

As users grow more sophisticated, the Radio Shack-supplied operating system becomes more insufficient, and advanced operating systems are required. Here is a detailed summary of the two operating systems, followed by a set of conclusions based upon the comparisons.

General Comparison

FLEX is a product of Technical Systems Consultants, Inc. (TSC). It is a very popular operating system for 6800- and 6809-based computer systems. It supports 5¼- and 8-inch floppies and hard disks. It is reasonably priced, reliable, well supported, easy to use, and well documented. A large quantity of system and application software is available for FLEX. Several companies have adapted it for the Color Computer, including Atomtronics, Data-Comp, Frank Hogg, Spectral Associates, and others.

OS/9 is a product of Microware, Inc. It is a newer family of operating systems for 6809-based computer systems, with major versions 1 and 2. (Since most features are shared by both versions, they will be discussed as one operating system, with differences noted.) Microware has adapted version 1 for the Color Computer.

Version 1 supports 5¼- and 8-inch floppies and hard disks. It is substantially higher-priced than FLEX and has yet to

gain the popularity or momentum that FLEX enjoys. It is reliable, well supported, and well documented. Although it is gaining popularity steadily, a smaller amount of system and application software is available for OS/9 than for FLEX.

The primary advantages of OS/9 over FLEX lie in the areas of security, expandability, and ease of interfacing to new devices. OS/9 supports a file security system providing basic control of file access and update, whereas FLEX provides very little file security. On both systems, however, assembly language programs may, with some amount of difficulty, circumvent the file and memory security systems.

Without changing the basic structure of FLEX, the use of more than 64K bytes of RAM and 16 Megabytes per disk drive is very difficult, whereas OS/9 handles both easily, up to 1 Megabyte of RAM (version 2) and 1 Gigabyte per disk drive.

OS/9 is also automatically multi-user and multi-tasking, as opposed to FLEX, which supports multi-tasking only in the form of printer spooling.

FLEX and OS/9 version 1 realistically require a minimum of 64K bytes. OS/9 version 2 requires a minimum of 128K – 256K bytes for normal operations. For this reason OS/9 version 2 will not run on a Color Computer.

FLEX Human Interface

The FLEX command line format is generally very simple, and may be represented syntactically as follows:

[P1] ... [Pn] COMMAND [O1] ... [On] [:...]

where: P1 – Pn are optional pre-command strings such as printer names, etc.; COMMAND is a command string naming the program to be executed; O1 – On are optional parameters; and [:...] represents optional multiple commands. A FLEX command is simply a FLEX file name, which is formatted as follows:

[DR:]FILENAME[SUF]

where: DR is a drive number (0 – 3); FILENAME is a 1 – 8 character file name; SUF is a 1 – 3 character suffix.

Commands default to the system drive number and other files default to the work drive number. In the case of multiple commands on a line, they are executed sequentially, left to right.

FLEX has a number of system commands, including an editor and an assembler. A larger number of utility and diagnostic programs are available from TSC. There are no programmatic differences among these classes of commands, except that some may be designated as memory resident and become, in effect, part of FLEX.

There is also a very sophisticated assembly language level debugging facility provided, called DEBUG.

OS/9 Human Interface

The OS/9 command line format may be as simple as the FLEX format in some cases, but is generally much more complicated. Its format is as follows:

COMMAND [O1] ... [On] [<FI] [>FO] [>>FR]
[Caret PI] [&] [:...]

where: COMMAND is the name of the module to be executed; O1 ... On are optional parameters; FI is an optional alternate standard input source; FO is an optional alternate standard output destination; FR is an optional alternate standard error output destination; PI is an optional pipelined command; & is an optional indicator specifying background processing for the command; and [:...] represents optional multiple commands.

An OS/9 command is simply an OS/9 file name, which is formatted as follows:

[/DIR1/ ... /DIRn/]FILENAME

where: /DIR1/ ... /DIRn/ is an optional designation of the file's location in the OS/9

tree-structured directory; and FILENAME is a 1-to-29 character file name starting with a letter.

Useful OS/9 commands are CTRL-Q and CTRL-C, which interrupt the task active on the user's terminal and usually return control to the terminal, killing the task.

Other capabilities of OS/9 not enjoyed by FLEX are "type ahead" and line repeat. The user is able to enter data and commands before they are actually used. The characters are echoed as they are processed. Even though the input may be mixed in with system output, OS/9 accepts the input as needed. The user is also able to request that OS/9 repeat the previous line of input up to but not including the carriage return, to simplify correction of errors or repetitive input.

Both commands and file names have the default position in the OS/9 tree-structured directory specified at user log-on or by the last "chd" and "chx" commands. Parentheses may be used to force alternate grouping of commands.

OS/9 has a large number of utility commands, including an editor and assembler, and those which might be designated as system commands, utilities, or diagnostics. There are no programmatic differences among these classes of commands, except that some of the commands are executed directly by the OS/9 shell rather than by a called program. Some may be restricted in use to the system manager only.

There is currently no assembly language level debugging facility provided except for a primitive program called DEBUG.

FLEX Program Interface

FLEX communicates with application programs simply and directly. The application program and FLEX share the same memory address space. Code in the application program may inspect and modify FLEX storage locations (and sometimes FLEX itself). FLEX services are usually requested by loading specified registers and storing parameters, then calling a FLEX subroutine through a vector address.

The file management system (FMS) is simple and elegant, using a file control block (FCB) for almost all file-related communications between programs and FLEX. Some limited device independence is implemented through the use of peripheral drivers.

♦ next page

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Since the FCB sector buffer length is 256 bytes and the FCB prefix length is 64 bytes, the entire FCB length is 320 bytes. This is sufficient to contain virtually all information required by the FLEX FMS to manage all open files on the system. When a program calls FMS and passes parameters to it through an FCB, FMS returns an error indicator (the hardware zero flag) and an error code in the same FCB.

OS/9 Program Interface

OS/9 communicates with application modules in a manner similar to that used on mainframes: each request is a system call (swi2), followed by a one-byte parameter. Other parameters are passed in registers and in memory between the application modules and OS/9 and vice versa.

Under OS/9 version 2, code in application modules may not inspect or modify memory locations associated with other users or OS/9, since they are mapped out of the memory allocation space. Each application module has access to the full 64K-byte address space, with program code normally loaded from the lower ad-

resses and the stack normally advancing from the higher addresses, each in 4K byte blocks.

An application module may create additional tasks and specify that they run in independent, concurrent, or pipelined mode, and, in the latter two modes, their progress and completion status be monitored.

Since the modules are assumed to contain pure position-independent code, they may be loaded as required in the logical address space, and multiple users of the same module share the same code, although each user has an independent data address space.

Because OS/9 is totally interrupt-driven, it should provide for higher overall system performance than does FLEX, despite the higher software and hardware overheads.

Assembler Comparison

The standard OS/9 assembler supports a small number of capabilities beyond those supported by the standard FLEX assembler. These were added to facilitate the use of the assembler in the OS/9 environment.

The format for an OS/9 system call in OS/9 assembly language is as follows:

os9 code

where code represents an 8-bit system call designation. For example, the following call:

os9 i\$read

would be equivalent to the following code:

swi2

fcbl i\$read

where i\$read is assumed to have been given a value elsewhere in the assembly, normally from the OS9DEFS definitions file. Parameters may be passed to or from OS/9 in the CC, D, U, X, and Y registers.

The OS/9 assembler supports two pseudo counters, one for data and one for code references. The program counter assists in the generation of (read-only) shared-text program code and constant-data areas which may be shared simultaneously by multiple users of the same

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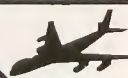
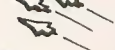
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program. Note that OS/9 assumes that the program code and data are position independent, and the assembler produces warnings for obvious non-position-independent code and data references. The data counter assists in the specification of uninitialized read-write data areas. If a data segment is used by multiple simultaneous users, each has a separate copy.

The FLEX assembler supports multiple, and any overlapping, code and program segments. The OS/9 assembler requires that all modules be contiguous and have an initial load address of \$0000, although, because of position-independence, the code and data sequences may be loaded wherever OS/9 decides to place them.

OS/9 memory allocation functions differently from FLEX. FLEX generally allocates memory as a binary file is loaded—in effect, all of user memory (below MEMEND) is available for user programs to access or modify. OS/9 allocates program and data segments according to the space requested, versus the space available. OS/9 version 1 is limited in its address range to 56K bytes, whereas OS/9 version 2 is limited to 1 Megabyte, and has memory relocation hardware to as-

sist in its allocation process. Multiple users of the same module share the code segment but each has a private space for the data segment. Modules may dynamically request additional data memory allocation using system calls, but will succeed in OS/9 level 1 only if contiguous memory space is available at higher addresses.

FLEX Disk and File Formats

FLEX uses a 256-byte disk sector format, of which the first four bytes are reserved for system use and the remaining 252 bytes are available for data storage. The first two bytes of the sector contain a link to the next sector in the file (or zero for the last sector), and the next two bytes contain a sequential count representing the logical record number, starting with zero.

FLEX supports 5¼- and 8-inch floppy disks in single- or double-sided, single- or double-density, single- or double-track density formats, and certain types of hard disks.

In order to maintain vital information about a disk, FLEX maintains a System Information Record (SIR) in sector 3 of

track 0 on every formatted volume. Sectors 1 and 2 of track 0 contain the bootstrap program for FLEX and, on a bootable disk, sector 1 contains a pointer to FLEX's location on the disk. The remainder of track 0 is occupied by the directory. Each directory entry contains the following information about a file: name; extension; attributes; starting disk address; ending disk address; file size; file sector map information; and creation date.

If so many files are on the disk that the entire directory cannot be contained on track 0, it is extended by stealing sectors from other tracks.

For compatibility purposes, track 0 is always recorded in single-sided, single-density mode. Thus, FLEX can always determine the characteristics of a disk by reading the SIR on sector 3 of track 0.

FLEX supports text files, binary files, and random files.

Text files are intended to contain printable ASCII data, organized into variable-length records, each terminated by an ASCII CR (hex 0D) character, and possibly containing certain other ASCII characters, such as LF. In order to save space,

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contiguous groups of more than two spaces are compressed during output to disk and expanded during input from disk. This is done by recording an ASCII HT (hex 09), followed by a byte representing a count (3 to 127) of the number of spaces substituted. ASCII NUL (hex 00) and CAN (hex 18) control characters are ignored, but all other ASCII control characters (except HT) are passed unmodified to a requesting program.

Binary files are intended to contain object programs. Since any sequence of data is possible in such files, no compression or expansion is performed; however, no indication of whether a file contains text or binary data is maintained in the file or directory, so a user program must have external information about a file and set the space compression flag in the FCB accordingly.

Binary files are composed of two types of records. The first, a memory extent, is composed as follows: ASCII STX (hex 02) — header indicator; address most significant byte; address least significant byte; number of data bytes following; and data. The second, a transfer address, is composed as follows: ASCII ACK (hex 16)-header indicator; address most sig-

nificant byte; and address least significant byte.

The memory extents are normally loaded directly into memory at the addresses indicated. The last transfer address encountered in a binary file is normally used as the address at which execution is begun in a load-and-go situation. Programs may also be only loaded without execution, and at fixed address offsets.

Random files are intended to be used for non-sequential processing, as opposed to text and binary files which are normally processed sequentially. Text and binary files may be processed in a non-sequential manner, although FLEX does not directly support such access. Random file records are fixed-length at 252 bytes and each logical record occupies one physical record. A flag in the directory of a random file indicates the random mode and that the first two sectors of the file contain a file sector map that relates logical record number to physical disk address for each record in the file. Random file records may be read and/or modified, and the files may be extended by writing higher record numbers than previously allocated. In case a ran-

dom file is moved or extended, FLEX automatically corrects the file sector map.

OS/9 Disk and File Formats

OS/9 uses a 256-byte disk sector format, with all 256 bytes available for data storage. File linkage and allocation information is maintained externally to the user-accessible data records, eliminating the possibility for destruction of file linkage information which is present in the FLEX scheme.

OS/9 supports 5¼- and 8-inch floppy disks in single- or double-sided, single- or double-density, single- or double-track formats, and certain types of hard disks.

To store information about a disk, OS/9 maintains an Identification Sector in sector 0 on every formatted volume. This sector contains the following information: total number of sectors on the media; number of sectors per track; number of bytes in allocation map; number of sectors per cluster; starting sector of root directory; owner's user number; disk attributes; disk internal identification; disk format: density, sides, etc.; number of sectors per track; reserved for

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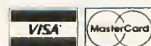
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future use; starting sector of bootstrap file; number of bytes in bootstrap file; time of creation (yymmddhhmm); and volume name.

Since track 0 is recorded single-sided, single-density, OS/9 can always determine device characteristics from sector 0.

Each directory segment is 32 bytes long, composed of a 29-character file or directory name and a three-byte logical sector number pointing to the file or directory header.

OS/9 files are of one type. Any file may contain any ASCII character and no compression is performed. Any file may be accessed and updated sequentially or randomly.

Binary files have been discussed in the context of memory allocation and assembly language programs. Binary files contain a header record and code record for each module. When a binary file is loaded, all modules in the file are loaded, and the execution address of the first module in the file is used for the initial program counter. A data segment is established initially only for the first module loaded. The format of the header record is as follows: \$87CD-header indicator; code length in bytes (16 bits); name

name offset (16 bits); type (8 bits) — type and language; attributes (8 bits) — attributes/level; header parity (8 bits); execution offset (16 bits); and data length in bytes (16 bits).

The module code record follows immediately after the header record, and is loaded into memory after the header record. At the end of the code record is a three-byte Cyclic Redundancy Checksum, which is computed based upon the header and code records, and is also loaded into memory.

Color Computer FLEX Versions

There are several versions of FLEX available for the Color Computer and the TDP-100. All use the same interfaces with programs and users, share the same assemblers, and use the same file systems. However, there are differences among the systems. Since the major FLEX systems in current use are marketed by Data-Comp, Frank Hogg, and Spectral Associates, they will be discussed here.

Most differences are internal and affect only the extensions to the program interface required to support the capabilities and solve the problems of the Color

Computer and TDP-100. Some of the differences are external and the *user must* be aware of them to use the system properly.

One of the first attributes of a system the user deals with is the method of system installation and customization. The Data-Comp FLEX system must be installed by following a reasonably elaborate sequence involving the user entering several commands and copying several disks, whereas the Frank Hogg and Spectral FLEX systems are delivered ready to run. This is because Frank Hogg and Spectral have purchased licenses to modify and remarket FLEX, but Data-Comp has not yet done so.

The manuals for the various systems reflect degrees of emphasis on technical skills. All provide detailed installation instructions. Frank Hogg and Spectral provide the *FLEX User's Manual* and *FLEX Advanced Programmer's Guide* from TSC, but Data-Comp does not. All provide descriptions of the additional utilities they have added. All provide lists of such implementation-dependent details as the keyboard and screen interfaces.

The Spectral FLEX system currently re-

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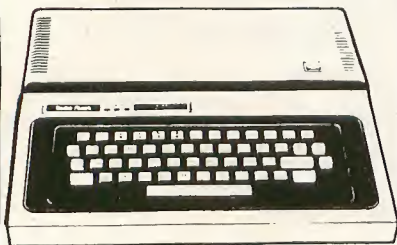
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quires the use of their Supercharger, a hardware addition that plugs into the ROM port socket and into which the disk controller plugs. This device allows an unmodified Color Computer or TDP-100 (with 32K bytes and Extended Basic) to be used to run their FLEX. None of the other FLEX systems tried will run with the Supercharger installed. Also, since the Supercharger is unshielded, it may cause television interference.

The keyboard and screen interfaces are different among the FLEX systems. Extensions to both are required because the Radio Shack-supplied keyboard and screen interfaces are insufficient for use with such programs as word processors. Frank Hogg and Spectral FLEX systems are the most compatible, using almost identical keyboard and screen interfaces, although both are incompatible with the Data-Comp FLEX interfaces.

Frank Hogg and Spectral Associates provide a keyboard driver capable of generating most ASCII codes, using various combinations of the Shift, Up Arrow, letter O, and Break keys. The Data-Comp system provides a keyboard driver capable of generating most ASCII control codes, plus a set of twelve user-defined Clear key combinations, which allows the generation of a subset of the missing ASCII codes.

All three versions of FLEX support a 51-column by 24-row screen format, in addition to the 32-column by 16-row screen format of the MC6847 CRT chip's character generator. Frank Hogg and Data-Comp FLEX systems provide other formats, such as 42 columns by 24 rows, 64 columns by 24 rows, and 64 columns by 32 rows. The last two formats are hardly readable, however, except in very specific cases, such as all-numeric screens. Spectral FLEX does not provide additional screen formats.

Frank Hogg and Spectral Associates provide very similar cursor control codes, allowing user programs to set the cursor to any position on the screen; move the cursor up, down, left, right, or home; erase to end of line or end of screen; sound a tone; and so on. The Data-Comp system provides fewer cursor control abilities, not currently providing the ability from a program to, for instance, move the cursor up one line.

All three systems provide vector or jump addresses for programs that require direct I/O to the keyboard and screen. This includes such things as a keyboard scan with no echo. However, the addresses and functions provided by the

routines are different among the systems. Again, Frank Hogg and Spectral FLEX program interfaces are more similar to each other than to Data-Comp's interface.

The Spectral FLEX system provides a rather comprehensive monitor function, providing the abilities normally found in a ROM monitor, such as inspecting and modifying memory, setting and clearing breakpoints, executing instructions beginning at a given address, converting from hex to decimal or vice versa, etc. This greatly assists a user attempting to debug small assembly language programs without the TSC DEBUG program. The other FLEX systems each provide a utility for inspecting and modifying memory locations. Such programs should be used with great care, however, since the user can destroy the contents of memory and potentially corrupt disk sectors.

Both Data-Comp and Frank Hogg systems provide a utility for configuring the system in terms of disk drive step rate. Frank Hogg FLEX provides additional capabilities in its utility for configuring the system for the printer and for modifying certain screen driver and other parameters. Spectral FLEX currently requires binary patching to accomplish such configuration modifications.

All three FLEX systems provide access to the Radio Shack Basic ROMs in various degrees. Data-Comp FLEX reads the Extended Basic ROM into RAM and modifies it to load and store FLEX formatted Basic and machine language programs. None of the systems modifies the Radio Shack Basics to allow Basic programs to read and write FLEX formatted disks, so the capability is not necessarily as powerful as it seems at first.

The Data-Comp FLEX system provides several disk-oriented utilities. One allows the user to interactively display and change disk sectors on FLEX and Radio Shack disks. Another allows the display of the directory of a Radio Shack disk. Still others allow the transfer of files between FLEX and Radio Shack disks in both directions. This includes both source and object files, although further processing may be required to modify data formats before they may be used by the Basic interpreters or before machine language programs may be loaded and used. All three versions of FLEX have a single disk copy program, required to copy data files on single drive systems.

The Frank Hogg system provides a very useful capability in its HELP command. Most of the FLEX commands and utilities

are briefly described by this command, on demand. It is most convenient to a user new to FLEX to have prompts available for the use of the system. The user has the capability to modify the file used by the HELP command to add additional keywords and explanations.

Conclusions

No computer, system, or computer operating system is always the best when compared to all others under all conditions. Whether OS/9 or FLEX is more useful depends, of course, upon the circumstances under which the system will be used.

FLEX is a far more friendly and forgiving system than is OS/9. For instance, FLEX provides a wild-card facility to materially shorten cataloging, copying, deleting, and other operations while OS/9 provides no such facility.

OS/9 provides multi-user access, which FLEX does not provide. Thus, OS/9 may be much better for real-time data acquisition and process control than is FLEX.

For the purposes of assembly language program development, FLEX provides many features which OS/9 does not, such as an adequate debugging facility, and is free of many of the restrictions OS/9 imposes on all programs, such as position independent code and data.

For the purposes of Basic language program development for business use, FLEX's Extended Basic provides 17 decimal digits of precision (56 bits) versus OS/9's BASIC09, which provides nine decimal digits of precision (40 bits), totally insufficient for accounting work. However, OS/9's BASIC09 language provides very fast execution compared to TSC's Extended Basic.

There is far more software available for FLEX than for OS/9, partially because FLEX is older and partially for the reasons just elaborated. This is especially true in the areas of business and accounting software.

If a requirement of the operating system is multi-user access or the development of drivers for specialized hardware to be connected to the system, OS/9 is a better choice. If the standard set of hardware normally supplied with one of the systems supporting FLEX is adequate for most purposes, FLEX may be a better choice, since it is easier to use. The choice is the user's.

— by E.M. Pass, Ph.D.

Portions of this paper were presented at *Electro '83*.

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THIS REVIEW will cover three companies whose software is designed for early childhood education. These companies (Follett, Strawberry, and Radio Shack) are not the only ones with software for early childhood education; however, I have had the opportunity to work with, and observe young children working with, these particular programs.

The Juggles' Series

Follett Library Book Company offers Juggles' Rainbow, which was originally developed for the Apple computer. Follett has made it available for the 16K Extended Basic Color Computer. The Juggles' Rainbow package contains three programs: "Juggles' Rainbow," "Juggles' Butterfly," and "Juggles' Windmill."

"Juggles' Rainbow" covers the concepts of above/below; "Juggles' Butterfly" introduces left/right; and "Juggles' Windmill" uses above/below/left/right.

After the menu, "Juggles' Rainbow" shows a blue strip on the screen and the child is asked which portion of the screen

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is above the blue strip and which is below. No keyboard response is necessary at this point.

After five above/below tests the program goes on to the second level. Again, the blue strip appears and the child is asked which is above and which is below. Two wrong answers returns the user to the first level.

"Juggles' Butterfly" and "Juggles' Windmill" incorporate the same aspects of the first two games.

The programs are easy to work with, although young children will require the assistance of an adult or teacher. Directions supplied in the users' manual are colorful, clear and concise.

The Juggles' activities are designed to develop math and reading readiness skills, and help prepare children for school. These programs can be used with children ages three to six. They are available from Follett Library Book Company — Computer Division on tape for \$37 and disk for \$50.

Strawberry Software

Strawberry Software has four programs for early childhood use. They are: "Jesse's Busy Bugs," \$9.95; "Rainbow Forest," \$14.95; "Counters," \$19.95; and "So Big, So Small" for \$12.95.

"Jesse's Busy Bugs" is a sound and graphics program designed as an introduction for children who have never used a computer. Directions are clear and it is suggested that this program be used with children ages sixteen months to three years.

"Rainbow Forest" is for children from four to six years old. This program introduces the use of the joystick to the child. The object is for the user to move the flashing cursor (flitterbug) to the spouts placed at random on the screen. Once this is accomplished the spouts become trees. A second level allows the child to find treasures and place them in a treasure chest. This program helps the student develop eye-hand coordination.

"Counters" has three levels and is designed for children from four to seven years of age. The screen shows a variety and number of different shapes and asks the child to guess how many of the same shape are on the screen. If there are six circles, four squares and two triangles and the child guesses four, that answer is correct. This level of the program doesn't ask for the name of the different

shapes, only the number. Level three requires the child to distinguish differences between shapes.

"So Big, So Small" lets the child draw shapes on the screen. The child only has to depress keys 1 — 4 (for shapes) and keys 8 and 9 (for size changes).

The Strawberry Software programs work well with young children. I would have preferred the inclusion of a Break key disabler. If that key is accidentally depressed the child must type RUN and Enter to access the program.

Popcorn

"Popcorn," produced by Radio Shack, is an excellent program to introduce the computer to young children. This program operates with a joystick. It was designed by Radio Shack as a game (catch the falling popcorn with the five steps); however, at lower levels it teaches young children eye-hand coordination and left-right directionality. This program is available in ROMpak for \$24.95 at all Radio Shack Computer Centers.

T.C.E. has developed an alphabet program that displays large block capital letters with an accompanying picture and alphabet song. This program is excellent for reinforcement of letter recognition. Another version may soon be available that includes the lowercase letters. It is available on tape for \$19.95 and disk for \$24.95. In addition, custom graphics are available upon request for an additional cost.

—by David Macali

Micro Color Terminal

Spectrum Projects
93-15 86th Dr.
Woodhaven, N.Y. 11421
\$25

ONE MAIN USE for a home computer is telecommunication. Whether used to contact the large on-line systems such as CompuServe, the

local BBS systems which are springing up around the country, or by a businessman to contact the main computer at the home office, the microcomputer shines.

With Radio Shack's introduction of the new MC-10, a vast market exists for software. The most logical first step is a communications terminal package. One such program is available from Spectrum Projects.

The terminal program is supplied on cassette tape, currently the only storage media available for the MC-10. The documentation includes instructions for loading the program, and also includes a warning about the unique cassette load feature of the MC-10. It does not automatically shut off the cassette after the load is complete.

To run the program, first place the tape into your tape player and push the play switch; then type CLOADM. This is really very interesting since, according to Radio Shack, the MC-10 does not have a CLOADM command. It also points at the dedicated work of the author, who wrote a fine program for a machine providing very little (4K) memory with which to work. Once the program is loaded, the cursor returns and the user is instructed to type another undocumented command: EXEC. At this time the Micro Color Terminal banner appears on the screen. The user may then place a call via proper modem procedure, sit back, and communicate with the computer world.

Keep in mind this is a bare bones program with none of the features of the expensive "smart" terminals. On the other hand, the MC-10 is a bare bones computer which, in its present state, is not capable of the more sophisticated features. The potential owner should consider one major point: *price!* It can be purchased for \$110, a basic modem is available from Signalman for \$90, and the terminal software sells for \$25. A beginning computerist can be on-line for about \$225. This is not a bad price when you consider you also have a very nice little computer to play with when your calling is done.

The Micro Terminal package is a well-written machine language program which takes advantage of the available 4K RAM and accomplishes its purpose with no frills or fancy stuff. The documentation is clear and well written, and the author supplies two copies of the program on the cassette in case one is accidentally destroyed. The program is not copy protected, but the start, end and EXEC addresses are not supplied.

I am using the Micro Terminal to check

out operation of my BBS (Color 80 of Youngstown OH, (216) 788-7910) from remote locations and find it to be simple and reliable. When 16K expansion is available for the MC-10, a buffer should be added to the program. This will certainly add to its value and utility.

— by Larry Cadman

The Composer

Speech Systems
38 W 255 Deerpath Road
Batavia, IL 60510
(312)879-6880

16K tape or 32K disk
\$24.95 Cassette
\$29.95 Disk

Synther-7

Computerware
Box 668
Encinitas, CA 92024
16K

\$21.95 Cassette
\$24.95 Disk

BETWEEN THEM, "The Composer" and "Synther-7" would make up a nearly perfect music program for the Color Computer. If their authors were to meet and shuffle the two programs together, everyone would benefit.


"The Composer," by Richard Parry, will interest those with a more technical interest in music. Its format is two linked modules, one Basic and one machine language, with a loader. The program offers four simultaneous voices over seven full octaves, tape storage of source code (as Basic data statements) and of compiled music in the machine-language module, easy correction of mistakes and changes of pitch and tempo.

The user deals directly with the Basic module, which offers the following menu:

1. LOAD SOURCE (BASIC)
2. COMPILE SOURCE
3. PLAY MUSIC

♦ next page

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REVIEW\$

4. MODIFY TEMPO
5. MODIFY KEY / OCTAVE
6. SAVE COMPILED MUSIC (ML)
7. SAVE SOURCE (BASIC)
8. END OR EDIT

The user can specify the duration of notes over a wide range, and enter triplets and sextuplets as well as dotted and double-dotted notes when entering source code. (These methods alter the duration of individual notes and groups of notes without a change in time-signature.)

The user cannot control volume or the "envelope," that is, the attack, decay, sustain and release rates of its voices. These factors might be manipulated to simulate a variety of instruments or produce a hand-tailored sound. (see review, August, 1983, by Kitsz, for in-depth look at this program.)

"Synther-7" allows the missing control. It also furnishes 10 pre-set stops, two versions each of what are quaintly called Gamba, Hogfife, Jninni, Krump-horn, and Lute. Controls for volume, vibrating and sliding notes, octave changes and "twang" offer more settings than a beginner will need, or probably even hear.

Its shortcomings are exactly "The Composer's" strengths: just one voice, no storage in correctible form (both programs let you record the music in performance, but that is not the same thing), and input limited to a two octave range at any one time. It does offer direct keyboard performance, so the computer can become a one-finger "piano," along the lines of the original Moog synthesizer.

Although the control the user has over the actual noises produced makes it ultimately more flexible (and satisfying to the expert) than "The Composer," the absolute beginner will be able to produce a variety of pleasing or strange sounds with no prior instruction, and with only the aid of the brief but adequate documentation.

"Synther-7" is copy-protected, unlike "The Composer."

Neither program gives the user any real control over the pitch of individual notes, or over the temperament of the scale provided. ("Temperament" refers to various methods of mistuning individual notes to fit them into exact octaves. It is a scandal of mathematics that notes separated by true intervals never quite match up from one octave to the

next so this "tempering" is needed for the music enjoyed in the West.)

While not a serious limitation, it would be delightful to have accessible the multitude of "ethnic" scales, or Mean Tone temperament (a scheme in favor before Bach's time, which tuned several intervals to their true values, unlike the currently-accepted Equal Temperament, which mistunes all notes equally so that no particular discord stands out).

Both programs pretty well preclude any sudden stresses or loud and soft effects: "The Composer" because it lacks the capacity, and "Synther-7" because it is impossible to make such changes during performance. (The space bar does offer a sort of "swell," though.)

We have, then, two programs which dramatically expand our ideas of what the Color Computer can do. Both have serious limitations, but not the same ones. Now we need a genius — could his name be Dennis? — to write a program which will give us all the capabilities of both at once. Until then, both programs are indispensable.

—by R. W. Odlin

Speak Up!

by David Dubowski
Classical Computing, Inc.
P.O. Box 3318
Chapel Hill, SC 27515
\$29.95

SOME OF THE more novel utilities developed for computers in recent years are the programs and devices that allow a computer to speak. Although the process to generate flawless speech from a computer is still an inexact science, newer and more powerful machines have put the talking computer into the hands of the average computerist.

Speak Up! is a "text-to-speech" machine language voice synthesizer program for the Color Computer. Speak Up! requires no hardware device, because the program creates the speech, and sound is produced via the television speaker. The sound output goes to the TV speaker and also to the record plug of the cassette. This lets you record the voice output directly on tape.

The program comes on cassette and

contains a 16K and a 32K version. It is just over 7K in length and loads at the top of memory, hence the need for two versions. Before loading Speak Up!, you have to reserve space, using the Clear command, to prevent Basic from overwriting the program.

The program's documentation is well written, and provides examples for setting up both versions, as well as Extended and Color Basic. You can use Speak Up! by itself, or call it from a Basic program.

After loading and executing the program, a title page is displayed with the copyright and the prompt INPUT>. At this point, type the words you wish spoken, followed by Enter. Up to 255 characters can be spoken at once. Thirty-seven phonemes are incorporated into the program to produce speech. (Phonemes are the basic sounds that make up the pronunciation of our letters or combination of letters.) To conserve memory, some of the English phonemes were eliminated, but most can be imitated by combining other letters. The documentation provides several examples of spelling for better pronunciation. For example: computer is better pronounced "compewter." Also included is a list of pronunciation and grammar rules.

The speech has a monotone quality, similar to the "starter" in Radio Shack's Skiing ROMpak. Most words are easily understandable, although finding the spelling that produces the best pronunciation takes a little practice. After several words, I was able to pick a suitable spelling within three tries. At times the speech is choppy, and the consonants in a few words seemed under-pronounced. I was usually able to correct this by adding an extra delay (there are three delay lengths) to smooth out words, and an extra consonant usually restores those that seem a bit weak.

The program contains a provision for changing the tone of the voice by POKE-ing a value into the delay byte location. This changes the pitch of the voice, but unfortunately, also changes the rate of speed. I found that any significant change in pitch (male to female for example) rendered the voice unintelligible. Values close to the default value of 13 produced the clearest speech.

Speak Up! is a fine utility with countless applications: in games, to add that extra touch; in business programs, providing user friendliness; and hours of amusement for you and your friends. So "HEERS TAWKING AT YUE KID."

— by Mark Marston

Game Writer

by Larry Kheriaty
Washington Computer Services
3028 Silvern Lane
Bellingham, WA 98226
(206)734-8248
\$89 ROMpak

THE DOCUMENTATION calls it "An exceptional program for the TRS-80 Color Computer"; I have to agree. Game Writer is the answer to all those frustrated people who've said, "The salesman told me I could write my own games, but how?" Now there is a way.

Basic is not a good arcade game writing language. Game Writer is.

Game Writer comes on a ROMpak so that it becomes part of the operating system and takes up no RAM. It reformats the screen in its own 32- by 24-column format using a high-resolution screen allowing you to print text with your game graphics. Programs are entered using an easy to master screen editor. The editor allows you to enter your programs and then alter, correct, and add to them using arrow-key cursor controls and shift-arrow key insert and delete controls.

The power of Game Writer, though, lies in its structure as a language. It is a Logo-like language that uses procedures similar to Forth. Thus, it is a much more structured language than Basic. It allows you to control an unlimited number of objects called *sprites*. The sprites are defined by simple shape tables you create and which, once defined, can be moved about the screen at will. The command set is simple enough, but contains everything needed to set up arcade-type games.

The manual is good. It is well organized, well paced, and completely covers the features and operations of Game Writer. The manual's best feature is a list of short sample programs in the back.

Game Writer is not an authoring system. The cartridge must be present in the computer in order to run the programs you write. Programs written using Game Writer must be run under Game Writer, just as Basic programs must be run under Basic. Even so, Game Writer affords the amateur programmer an opportunity to write fast, flashy games very quickly and simply.

— by Charles Forsythe

♦ next page



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Chromasette

P.O. Box 1087 Santa Barbara, CA 93102
(805) 963-1066

Early Games

Counterpoint Software
Suite 140
Shelard Plaza North
Minneapolis, MN 55426
(800)328-1223
\$29.95 Tape and Disk

EARLY GAMES for Young Children consists of nine educational and entertaining activities for the young child. The program's strengths are an emphasis on basic skills and the large, bright, colorful shapes, letters, and numbers used for graphics.

Most children will be able to run the program by themselves after a few sessions with adult assistance.

The program begins with a graphic display of the nine activities. Pressing any key will get you into each activity. You can escape from an activity by pressing Break at any time.

The first activity is "Match Numbers." In this activity a large colorful number appears on the screen. The child then matches the number by pressing the same key on the computer keyboard.

The new generation of students will have to become familiar with a slashed zero. With the increased use of computers a distinction between a 0 and the letter O is needed. Early Games has included this difference.

"Counting" is the second activity. Blocks are displayed on the screen and the child counts them and responds by pressing the correct number key.

The next two activities are "Addition" and "Subtraction." Both activities work the same way; the computer displays blocks and an addition or subtraction symbol, and the student enters the correct answer. There are three levels to this game, 10 problems in all. After answering questions 1 - 4, the child goes on to 4 - 7 and then 7 - 10. The displays are horizontal; this is not a major problem for early childhood education since many primary grade textbooks use this format.

"Matching Letters" is similar to the "Matching Numbers" activity. Again, a large colorful letter is displayed, requiring a matching response.

"Alphabet" is designed to take the child sequentially through the alphabet. A large, colorful letter is displayed and the child enters the next letter in the alphabet. *This activity doesn't* handle incorrect responses well. If an A is displayed and C entered, the computer

flashes a B. I prefer giving the child several incorrect responses before the answer is given.

The child learns to recognize and type his name in "Names." In this activity the child's name (or any word, for that matter) is typed and entered into the computer by an adult. The child then practices reproducing his name or the word.

In "Shapes" the computer displays four shapes on the screen. Each shape has an identification number and all are the same color. The child has to find the different shape and enter its number.

The last activity is "Draw." To use this activity, the child presses a key. According to its location on the keyboard a line is drawn. For example, the top keys draw up and the lower keys down.

All in all, Early Games is very good. The use of large, bold, colorful and bright letters and shapes is impressive. The program's main intent is to help the child recognize words, shapes and letters.

In most of the activities the computer does not accept an incorrect response. A try again prompt or a beep sound would be helpful.

If you have a young child, Early Games would be a good computer activity.

— by Marsha Kimmelman

Rearguard

by Coniah Software
Adventure International Publishers
Box 3435
Longwood, FL 32750
\$24.95 Tape

REARGUARD HAS SOME interesting and fun features. I like the way the mountains move as if three-dimensional. While piloting your support ship of the Earth Air Force and guarding a diplomatic mother ship of the Milky Way Galactic Federation, you get to shoot at a lot of different types of enemy nasties and watch the terrain roll by. The graphics used to separate foreground and background mountain ranges are nicely done, so the foreground range appears to be moving at a faster rate. It's nice to watch.

Meanwhile, enemy ships are coming at you from the left side of the screen and you have only vertical motion at your command. You do have a shield to help protect you and ram the enemy ships

with, but it uses a lot of energy. Be warned: use your joystick skills rather than the easier shield method of smash and run. Meanwhile, lots of action is going on and you have to watch your fuel gauge. Occasionally a fuel ship comes along, but this happened for me only during the practice sessions. I never lived long enough in the real games to get near a gas station.

A word of warning about the lasers. If you fire too fast, the first laser burst disintegrates and never reaches the target. However, this can be a help if you see that one of your shots has no chance of hitting an enemy ship; if you fire again right away you'll have lost precious little time and energy.

Another interesting thing about the foreground/background 3-D effect is that the ships can go down in between the mountains and hide. The only drawback to the graphics is the jerky, hypnotic motion of the ships and the screen. Everything moves as if being pulled by a rhythmic string. It would have been nicer if motion was smooth and easier to follow.

Rearguard has a practice mode, one person, and two person modes, and there are two levels of difficulty. The first level takes place in some planet's atmosphere, as far as I can tell, with the mountains continuously scrolling by. The second level of difficulty takes place in space and is much faster. Without the graphics routines taking up so much space and time in the second level, the ships move along at a good clip and without any jerkiness. However, it becomes a great deal harder to come close to winning.

The game is fairly simple and enjoyable, especially the moving mountain scenery — even if the visual pattern is jerky. The authors of the game inserted an incredible number of enemy ships with myriad capabilities, making it fun just to see what is going to come at you next. There are even pithy little remarks at the top of the screen when the next wave starts coming. Some of the remarks are helpful hints, especially concerning fuel.

When you play the game, watch your shield and fuel gauges carefully — that really won't help much unless you get the right breaks, but it adds to the reality of the game. Many a time I've been stuck in space, out of fuel and far from home.

All in all, Rearguard is a good game, with some nice graphics and lots of different bad guys, but the jerky motion of the graphics takes a bit out of your concentration.

— by Leslie Venable

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The ProtoEPROM-CC is an EPROM burner capable of burning 2716, 2732, and 2732A EPROMs. It is completely powered by the computer. It enables the user to create his own ROMpaks. It also contains 4K RAM so that EPROM images can be debugged before being committed to EPROM. The ProtoEPROM-CC plugs into the ROM port of the Color Computer and has a socket that will accept another ROMpak or the disk. This lets EPROM images be saved and loaded to and from the disk. The ProtoEPROM-CC is \$149.95, including shipping in the USA.

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Pirator

Sugar Software
2153 Leah Lane
Reynoldsburg, OH 43068
(614)861-0565

The Pirator from Sugar Software can help protect your programs from piracy. The program protects machine language or Basic programs, and is encrypted to prevent Listing or disassembly. Users can create non-executable back-ups. The loader displays a graphic title screen, and loads and starts the program. The program is usable by machine language and Basic programs, and has a Break key disable

for Basic programs. Pirator requires a 32K disk-based system and is priced at \$99.95.

Circle No. 87 on Reader Service Card

Color File

D & M Software Publishers
1510 South 97th Street
Tacoma, WA 98444

Colorfile is a cassette-based mail list system requiring a minimum of 16K and Extended Color Basic. You can maintain a mail list with as few as 50 names, addresses and phone numbers or establish a file to contain as many listings as necessary.

This program allows you to add or delete listings to and from your file and selectively edit any individual listing. The program knows how many listings you have on a cassette and will tell you how many can be added. You can print tab listings randomly, selectively, or alphabetically, in label format on plain paper.

Color File is priced at \$24.95.

Circle No. 88 on Reader Service Card

Electro-Optical Communications Dictionary

Hayden Book Company, Inc.
50 Essex Street
Rochelle Park, NJ 07662

The *Electro-Optical Communications Dictionary* is a comprehensive reference for the fiber optical and lightwave, data processing, and related manufacturing technologies fields. Edited by Dennis Bodson

and Dan Botez, this 168-page compendium is meant for users with technological backgrounds. Terms and definitions are consistent with international, federal, industrial, and professional societies' standards. Processes, devices, and components in electro-optical communications are clearly described. Cross-references and inversions are available, and a list of often encountered acronyms and abbreviations is provided. The book is priced at \$16.95.

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Circle No. 90 on Reader Service Card

MC-10 Speller

Eighty Computer Services
4811 Wickford Green,
Suite 11
Sylvania, OH 43560
(419)837-6294

The MC-10 Speller for Radio Shack's MC-10 Micro Color Computer helps students in all grades build their vocabulary. MC-10 Speller randomly presents one of 20 available words and asks for the missing letter, which is represented by a question mark. After three tries the program presents the properly spelled word. If the student guesses correctly, the computer responds and

continues to the next word. The available words are stored in data statements and are modifiable, as is the entire program. This allows program modification for full use of memory expansion or even foreign language drills. MC-10 Speller comes on cassette for 4K MC-10 Micro Color Computers for \$9.95.

Circle No. 91 on Reader Service Card

Secrets Of Better Basic

Hayden Book Company, Inc.
50 Essex Street
Rochelle Park, NJ 07662
(201)843-0550

Secrets of Better BASIC reveals sophisticated programming tricks and techniques for writing faster and more effective Basic programs. Written by Ernest E. Mau this 320 page book also offers programs for testing and debugging programs, more efficient use of memory, string-handling, using loops and subroutines, and creating disk files.

The book includes five appendices that include the ASCII codes and equivalents, numerical systems and conversions, some Basic functions, sample disk and memory tests, and some useful software. The book is priced at \$14.95.

Circle No. 92 on Reader Service Card

GRAFX-I & II

A & S Software
P.O. Box 1469
Dept. E
Pittsfield, MA 01201

GRAFX-I and GRAFX-II are two graphing programs for the Color Computer. GRAFX-I is for bar and line graphing on the screen and GRAFX-II is a bar and line graph program specifically designed for the CGP-115 plotter and the screen.

Both packages deliver full color, can be edited and replotted as needed. You can plot up to three independently labeled, multi-colored plots.

The bar graph lets you specify up to 12 bars including automatically labeled weekly or yearly plot. Options include absolute or percentage scale, grid and PMODE 3 or 4. GRAFX-I is priced at \$14.95, GRAFX-II is \$22.95 plus handling; they are supplied on 16 - 32K Extended Basic cassette.

Circle No. 93 on Reader Service Card

Trunk Accessories

Leading Edge Products, Inc.
225 Turnpike St.
Canton, MA 02021
(617)828-8150

Leading Edge introduces "Trunks," a series of disk storage units. These lightweight trunks are ideal for videogame computer cassettes and are portable, too. The products in the storage case line include: one that stores up to 18 cassette and game cartridges; another model that

stores up to 60 5¼-inch disks; and, a product that stores up to 60 8-inch disks. The suggested retail price of the last product is \$39.95, while the others are listed at \$29.95.

Circle No. 94 on Reader Service Card

Danger Ranger

Screen Play
500 Eastowne Office Park Suite 212
Chapel Hill, NC 27514
(800)334-5470

Danger Ranger is a new arcade-type game for the Color Computer. Written in machine language by Ken Kalish, Danger Ranger is a colorful, fast-paced, challenging game that demands speed and skill. The object of the game is to retrieve the keys that enable the user to find untold treasures. On the first level, you are pursued by flying eyes and deadly bats, which you must destroy with a photon pistol.



Photo. Trunk Accessories



KEYBOARD HELPS FAMILIARIZE CHILDREN WITH THE LOCATION OF COMPUTER KEYS. THE GRAPHIC KEYBOARD ENABLES THE USER TO FIND KEYS QUICKLY. HOME KEYS ARE IDENTIFIED AND PROPER FINGERING MAY BE TAUGHT TO OLDER CHILDREN. LESSONS ARE BUILT AROUND ALPHABET PRESENTATIONS AND LETTER DRILLS WITH A GRAPHIC REWARD COMPLETING EACH LESSON. WHILE YOUNG CHILDREN ENJOY KEYBOARD'S LETTER RECOGNITION ACTIVITIES, ADULTS MAY BRUSH UP ON RUSTY TYPING SKILLS. THE 32K VERSION HAS LENGTHIER TIMED DRILLS. DATA TAPE USE IS OPTIONAL WITH BOTH 16K AND 32K VERSIONS. ANY DATA TAPE MADE FOR B5'S SPELLING OR HANGWORD/SCRAMBLE PROGRAMS MAY BE USED WITH KEYBOARD, OR USE KEYBOARD PHONIC DRILL DATA TAPE. (SEE BELOW)
16K Cassette - \$19.95 / 32K Cassette - \$24.95 / 32K Disk - \$26.95

KEYBOARD Phonic Drill Data Tape - \$8.95

INTEGRATE LEARNING WITH USE OF THIS DATA TAPE AND KEYBOARD PROGRAM. STUDENTS TYPE LETTER, WORD, AND SENTENCE DRILLS USING COMMON VOWEL AND CONSONANT COMBINATIONS. REINFORCE PHONIC STRUCTURES WHILE LEARNING THE KEYBOARD. MUST BE USED WITH KEYBOARD PROGRAM (ABOVE). MAY NOT BE USED ALONE.

For use with TRS-80 Color Computer* & TDP-100*
with Extended Basic

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sugar
Software

PREREADER

will help your preschool (age 3-5) child learn to read with this easy to use menu-driven program. Great high resolution graphics, colors and sound effects. Your child will learn to identify capital and small letters, numbers, shapes and colors. After these skills have been mastered, the preschooler will learn to associate individual letters and consonant blends with sounds they make.



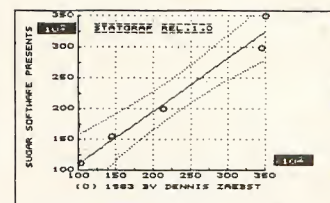
Requires 32K Extended
Basic and joysticks.

\$19.95
Disk \$24.95



STATGRAF

STATGRAF is a linear regression analysis program combined with a powerful but easy to use plotting/line graphing system. Designed for professional, technical, business, and educational use, among its many features are:



- *type titles & labels on the graph in any of three orientations;
- *position titles & labels where they will not interfere with the graph;
- *save data and completed graphs on disk or tape; display disk directory;
- *transform data: logs, square root inverse, exponential, additive codes;
- *calculate, display, & plot residuals;
- *powerful data editor: append, delete, insert, change;
- *plot multiple data sets; symbols include 5 figures or any text character;
- *calculate, display, and print regression statistics and tests of significance;
- *superimpose frame, regression line, 95% confidence limits, grid;
- *works easily with common machine language screen print programs (not supplied);
- *same program works with either tape or disk;

SUGAR SOFTWARE
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(614) 861-0565



Add \$1.00 per tape or disk for postage and handling. Ohioans add 5.5% sales tax. COD orders are welcome. Dealer inquiries invited.

CIS orders EMAIL to 70405, 1374

*TRS-80 is a trademark of Tandy Corp.

NEW:PRODUCTS

On the second level, Danger Ranger is on shifting platforms, dodging acid raindrops, pursued by floating skulls. The number of obstacles to overcome increase with each difficulty level. Danger Ranger requires 16K and a joystick, and is available on cassette for \$19.95.

Circle No. 95 on Reader Service Card

CoCo Board BBS

Lee F. Blich
507 Emory Circle N.E.
Atlanta, GA 30307

This CoCo Board BBS software is available in two versions: single drive, 32K compatible, and a two drive, 64K version. Both offer standard BBS features: enter and retrieve messages, users log, chat, bulletin, summary, set nulls and so on. In addition, the program will transmit low resolution color graphics to callers using Videotext or COLORCOM/E. Callers are notified at log-on of any

messages waiting for them. The two drive version adds private messages, string search/replace line edit, multiple picture retrieve, (graphics stored in upper 32K) and a download routine that uses the standard open/close buffer control codes.

Circle No. 96 on Reader Service Card

ColorMath

D & M Software Publishers
1510 South 97th Street
Tacoma, WA 98444

ColorMath is a math drill program that presents practice drill problems the *old fashioned way*. The program requires 16K minimum with Extended Color Basic and a cassette recorder. The program will also run on disk. You select the category: addition, subtraction, multiplication, or division (at various levels of difficulty), and tell the computer how many problems to generate. Random problems are presented on the screen in the same format as

in the classroom. All problems are presented in vertical textbook fashion. ColorMath costs \$19.95.

Circle No. 97 on Reader Service Card

New Publication

Games Guide
Subscription Dept.
6648 N. Newgard Ave.
Chicago, IL 60626
(312)761-1814

Arcadeo, Inc. presents
Computer Games Guide. The

guide will bring the gamer intelligent, critical reviews on the latest games in a clear, easy-to-read format. The *Computer Games Guide* covers Apple, Atari, VIC-20, Commodore 64, IBM PC, TRS-80 and Aquarius systems. Charter subscribers can receive 12 issues for only \$14.87. Subscriptions received by Sept. 30, 1983 will receive a thirteenth issue free!

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THE STEREO COMPOSER



YOUR COMPUTER NEVER SOUNDED SO GOOD

The **STEREO COMPOSER** music synthesizer was developed for the true music lover. All the features available for the **COMPOSER** described below are also available for the **STEREO COMPOSER**. However, instead of using the single 6 bit digital to analog converter built into the computer and the speaker built into your TV, the **STEREO COMPOSER** uses two 8 bit digital to analog converters which drive two audio power amplifiers. These amplifiers supply enough audio power to easily drive your own external speakers. If you like, the output may be connected to your home stereo system to further increase fidelity. Connection is provided by two phono connectors. If the music is too loud, two built-in volume controls are provided to allow you to control the volume of each of the channels separately. The advantage of being able to use external high quality speakers is obvious. The use of higher quality digital to analog converters serves to further increase music fidelity.

The **STEREO COMPOSER** produces music in stereo. Of the 4 voices produced, 2 are directed to each channel. This ability alone increases the realism of the music. You can even move the voices between speakers as the music plays.

The **STEREO COMPOSER** comes assembled, tested, burned in, with all the software and hardware to allow you to immediately start enjoying your music. A complete manual and examples are provided to give you everything you need.

The **STEREO COMPOSER** is completely compatible with the Radio Shack disk system. Any expansion unit will allow you to have both a disk and the **STEREO COMPOSER** operating.

Requires Extended BASIC and Minimum of 16K

STEREO COMPOSER (Hardware, Cassette and Disk) \$89.95



The **COMPOSER** is a 4 voice music compiler which easily allows one to develop high quality music. Each voice is programmed separately. In addition, each voice uses its own waveshape table which means a unique sound for each of the 4 voices.

The **COMPOSER** features a 7 octave range. It supports dotted and double dotted notes as well as eighth, quarter, and standard triplet notes. Sixteenth and thirty second notes are also supported.

The **COMPOSER** allows the music to be played at any tempo and in any key. And believe it or not, the tempo and key can be modified as the music plays. This gives the user tremendous versatility in developing music. Key modification also allows the user to move the music up or down one or more octaves.

The **COMPOSER** displays a constantly changing random kaleidoscope pattern as the music plays. In addition, the number of the note being played is displayed which aids one in finding sour notes during music development. Both of these displays can be disabled to allow any screen to be displayed while the music is playing. In this way, one can show the words to a song or display a picture as the music plays.

The **COMPOSER** develops a machine language position independent subroutine that can be Saved, Loaded, and Executed independent of all other software. This means that you can share your music with friends. In fact, you can write your own BASIC programs that call and play the music. Software vendors may include the music in their own product.

The **COMPOSER** is menu driven making it extremely easy and friendly to use and operate. A thick operating manual is provided as well as 20 minutes of music. Many examples are given to aid the user in getting started. All you need is provided, no additional hardware is necessary. Don't let the price fool you, the **COMPOSER** has got to be heard to be appreciated. For reviews see June '83 **RAINBOW**, p. 192 and May '83 **Color Computer News**, p. 74.

Requires Extended BASIC and Minimum of 16K

CASSETTE VERSION \$24.95
DISK VERSION (32K) \$29.95

THE VOICE



WHY PAY \$100 OR \$150 FOR A SPEECH SYNTHESIZER?

Buy the \$29.95 special and find out. Better yet, save your money and read one man's opinion in the August '82 issue of **CCN** on page 53. It's a fact of life that you get what you pay for. You simply can't accurately duplicate a speech synthesizer in software. Software synthesizers will give you either a limited vocabulary, use up a lot of memory, produce poor quality speech, or a combination of all three.

THE VOICE is a hardware synthesizer that plugs into the cartridge slot. It uses a sophisticated integrated circuit, the SC-01 by VOTRAX, to reproduce any word in English as well as other languages using phonemes. Phonemes are basic units of speech of which 64 are available at 4 inflections. This chip costs us \$55. If you supply the chip, deduct \$55.

THE VOICE has two outputs. Speech may be heard through the TV speaker, or the built-in audio power amplifier may be connected to your own external speaker. If the volume is too high, a built-in volume control is provided.

THE VOICE comes assembled, tested, burned in, with all the necessary hardware and software. A complete manual with many examples is provided to get you started in developing your own programs.

THE VOICE is completely compatible with the Radio Shack disk system. Any expansion unit will allow you to have both a disk and **THE VOICE** operating.

Software Included With THE VOICE

BINGO The VOICE announces the BINGO titles while you play the game.

MATH TUTOR The VOICE tutors your child in learning arithmetic.

HIGH LOW The VOICE gives you hints in guessing a number it has picked.

EDITOR This utility program will help you develop words phonetically.

THE VOICE (Hardware, Cassette, and Disk) \$149.95

THE VOICE (As above without SC-01) \$ 94.95

THE TRANSLATOR

The translator is a machine language program that uses a built-in dictionary and a sophisticated program algorithm developed by Del Software to automatically convert text to speech. For example, AS = "THIS IS ALMOST TOO EASY" followed by calling a USR will allow the VOICE to speak. The translator will even allow you to type words in one language (i.e. French) and have the VOICE speak in another (i.e. German). Nobody else gives you that flexibility. For 16K, 32K and 64K machines.

Software Included With The Translator

REACTION Test your reflexes as the VOICE gives you commands.

SIMON Test your memory for numbers spoken by the VOICE.

THE TRANSLATOR (Cassette or Disk) \$29.95

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END OF FILE



hen it rains it pours. The past few months have been exciting for Color Computerists. Tandy has released no fewer than five major new products for us. It began with the MC-10. Then came the Multi-Pak Interface, which has become my ROMpak port's favorite accessory. (It was suffering from insert/outsert abuse.)

It has been almost six months since I've had the pleasure of opening the box of a brand new Color Computer. The new Color Computer (the one with the fancy white suit and 64K) took care of that. A few days later OS-9 arrived with its three-inch thick documentation. One more product: Radio Shack's first Daisy Wheel printer with a serial port. Whew!

Tandy is not alone. It seems everyone is upgrading, introducing, and redesigning Color Computer software and peripherals at a dizzying pace. No complaints, keep it coming. But there is a downside...of sorts.

People are always asking me to recommend computer purchases. "What computer should I get?" "Which word processor?" "Which DBM?" "Etc.?" After I tell them my extremely biased opinion they usually follow with a description of some innovation they've read about that is expected to be available in a few months. "Shouldn't I wait for it to come out?" My answer is always, "No, by the time that feature comes out there'll be another one worth waiting for. If you want a computer, buy it now, today, right this minute."

I'm writing this using my new Color Computer (the one in the fancy white suit), with Nelson Software's newest version of Super Color Writer II, Amdek's spiffy little three-inch disk drives, and Radio Shack's new Daisy Wheel printer. Had I used my oldest Color Computer, Nelson's earliest version with cassette I/O and my old LP VII, the text you're reading

would not be any better (darn!). Had I waited for all the upgraded equipment I'm now using, I would have lost out on years of Color Computing. Because I didn't wait for the latest innovation I'm two years more knowledgeable in Color Computer use. That is worth quite a lot.

Not long ago I convinced a friend to buy a Color Computer. Many of you have probably done the same. You might have been faced with the same reaction from your friend when the white Color Computer came out. "You told me to buy this when I could have waited for that!" I sure did, and I would do it again.

Although this issue is dated October, most of you will be reading this in September. So, there's still time to plan your trip to Pasadena, CA in November for *Color Expo '83*. The event promises to be fun, informative, and warm (that would be of special interest to those of us living in northern areas. When we get home it'll probably be winter — brrrr.) **The Color Computer Magazine** staff will be there. We hope to see you basking in the sun at poolside. We also hope to see you at the show.

One final item: Software rental businesses are beginning to make themselves known. Most operate by charging a rental fee equal to anywhere from 15 to 25 percent of the software's retail purchase price. Customers, if they choose to buy the software after "trying it out," can apply the rental fee towards the purchase price. It's not hard to imagine how the system can be abused by software pirates. It's also not hard to imagine the long court fights looming in the future between software manufacturers and rental companies. Write and tell us your views on rental software. Do you like the idea, or do you think rentals are just another piracy scheme?

— K.L., Editor

FOR...NEXT (11,83)

November is graphics month — something to jolt you out of those grey early winter doldrums. And, graphics it will be!

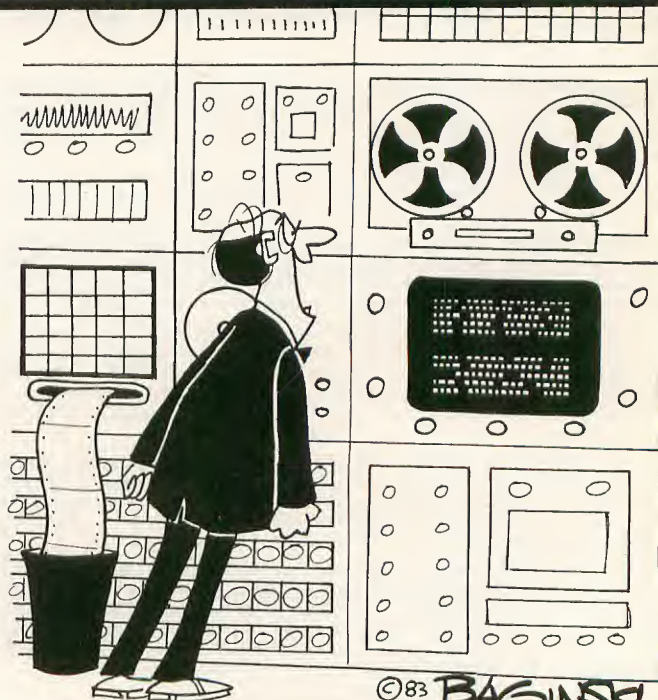
To start off we'll have part two in a three-part series for beginners, entitled "Graphics? Yes!" Scott Bain and Andrea Chartier have done a great job on this series.

Bill Barden is back with his inimitable wisdom concerning graphics and the Color Computer. Jake Commander has a super treat in store for us — remember Spirographs? Now meet Super Spirographs!

There are also some graphics surprises planned that we won't mention here.

Stephen Allen is a man of many talents, not the least of which will be evident in his game, "Slither." And for those of you who must get your home finances under control before the holiday season, take a look at Jamet's "Home Finance Manager."

All our regulars will also be back — "Color Computing for Kids," "GOTO School" for educators, Jake's disassembly, Kepner's Q and A column, and a Dennis Kitsz monthly treat, among others. Oh yes — a new "Sorcerer's Puzzles" is lurking 'round the corner! See you then!



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"My Radio Shack Micro Color Computer Has Incredible Power and Performance."

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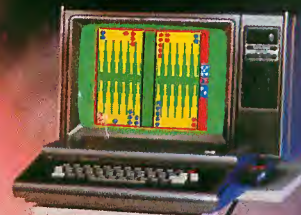
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—Isaac Asimov
Renowned Science and
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WITH
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NOW

JOYSTICK
COMPATIBLE

BY DALE LEAR

Down there — below and to the right — tongues of fire play across the face of a skyscraper like living things. Inside the copter, runaway temperatures nearly rip the consciousness from your heat-punished body, momentarily throwing you off course. But panic taps a hidden reservoir of strength, and with an adroit push on the throttle, your FIRE COPTER continues to knife through the swirling plume of smoke, carrying its lifesaving water jets directly into the flames.

FIRE COPTER is joystick-controlled and accommodates one or two players. Ready for three-dimensional realism? Then you're ready for FIRE COPTER — the hot new arcade game from Adventure International! Color Computer 16K Cassette \$24.95

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FOR YOUR COLOR COMPUTER

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